

GE
Energy

Integrated Plant Control for Hydro



imagination at work

A Scalable Hydro Control Solution



Mark VIe* is GE Energy's newest and most advanced control platform. It is applied in all types of power plants as a unit control for rotating machinery and a complete plant control system.

For hydro applications, it is available for all turbine types, along with a variety of unit configurations for auxiliaries. Ample I/O and computational power is provided to enable straightforward expansion from a governor control to a fully integrated unit control system. The distributed I/O design makes it easy and cost-effective to control and monitor temperatures, pressure levels, speed, main shutoff valves, etc. In addition, the system can extend to the plant, the dam, the substation or the entire river system. Local and wide area networks enable a cohesive view of the entire hydro infrastructure for central dispatch and remote monitoring and diagnostics.

GE Energy's EX2100* generator excitation controls are also available for hydro units. The EX2100 provides the same peer-to-peer communications and software configuration tool as the MarkVIe to simplify maintenance and training.

For asset management, GE Energy offers world-class Bently Nevada* condition monitoring and diagnostic tools.

A variety of operator and maintenance stations are available with GE's the Proficy™ family of HMI/SCADA systems and historians to complement the turbine controls.

Unit control, excitation, asset management, HMIs, plant control and river control are offered as both stand-alone and seamlessly integrated systems to optimize performance and minimize life-cycle cost in today's competitive hydro market.

System Architecture

Mark VIe has 100% networked I/O that can be clustered or distributed with individual I/O modules, local or remote, and connected with 100MB Ethernet. This flexibility is augmented with local processors on I/O modules for fast execution of critical loops. Computation power grows as I/O is added. The main processor board contains both internal and external Ethernet drivers for compact, yet flexible, communications.

Redundancy

Control systems are available in simplex, dual and triple redundant configuration. Redundant systems feature fault tolerance, precision diagnostics to minimize mean-time-to-repair and online repair to maximize system availability. Since networks are critical for control and monitoring, redundancy options are also available for all networks.

Networks

Ethernet is used at all levels including I/O networks, control networks with peer-to-peer communications between units and plant network interfaces. I/O networks use 100MB Ethernet and support category five or fiber for noise immunity.

Software Maintenance Tool

ToolBoxST* maintenance and configuration software is used for the complete system, from I/O board-level diagnostics to network operator stations and printers. Application software is represented in function block and ladder diagram formats with dynamic data that can be dragged-and-dropped between blocks or to trends with video type forward-reverse-freeze features.

I/O Types

- DI: 24, 48, 125Vdc, group isolated with 1ms SOE
- DI: 24, 125Vdc, point isolated with 1ms SOE
- DI: 115/230vac, point isolated
- DO: relays, form "C" contacts and coil or contact diagnostics
- DO: relays with 2/3 voting, "A" or "B" contacts
- DO: relays for solenoids with fuses, diagnostics and suppression
- DIO: 24, 48, 125Vdc inputs with magnetic relays and form "C" contacts
- DIO: solid-state 24Vdc, 125Vdc, 115/230vac
- AIO: +/-5, 10Vdc, +/-1ma, 0-20ma inputs and 0-20ma, 0-20ma outputs
- AO: 0-20ma
- Thermocouples: grounded or ungrounded
- RTDs: 3 wire, grounded or ungrounded

I/O Communications

- I/O Network – 100MB Ethernet Global Data (EGD)
- Modbus® via Serial or Ethernet
- PROFIBUS-DP Communications
- HART® Communications
10/2 Analog I/O

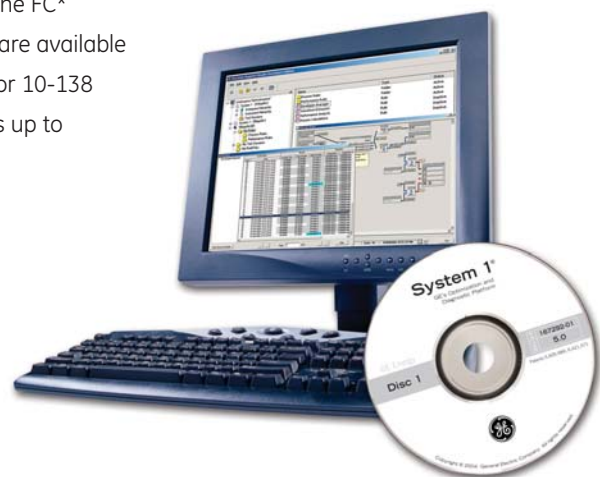
Key Station Control Components

Control and Protection of Rotating Machinery

GE Energy offers the same, proven systems for the control and protection of hydro turbine-generators as applied to combustion and steam turbines. This enables companies to standardize on spare parts, training and services across their fleet. Scalable turbine controls are available with the Mark VIe or the Woodward™ product families. Similarly, EX2100 offers a wide range of voltage regulators and full static excitation systems with experienced application engineering and custom power system studies. Additional generator protection can be seamlessly integrated on the station networks with GE's Multilin product family.

Mechanical Systems

GE has an engineering group that is dedicated to designing mechanical solutions specifically for hydro applications. Custom hydraulic upgrade kits fit in the same space as existing systems to minimize installation time and cost. Products such as the FC* family of distributing valves are available for turbines from any OEM for 10-138 bar (145-2,000 psi) and flows up to 23,700 lpm (6,260 gpm).





Hydro Station Control

The Mark VIe is ideally suited for complete hydro station applications with distributed I/O and a variety of common fieldbus interfaces, including Profibus and HART. Mark VIe's ToolBoxST software suite provides full access to configure hardware and software, local and remote, for rotating machinery and the entire station. Online download of changes are supported for application logic, I/O configuration, tuning constants, data recorders and third party communications.

HMI/SCADA

The Human-Machine Interface (HMI) provides a single window for the entire station. It serves as an operator and maintenance station with advanced graphics, alarm/event management, trending and other tools for report generation, export and web interface. The graphics user interface is based on Proficy HMI/SCADA iFIX® software and a Proficy Historian that can be embedded in the HMI or provided as a stand-alone Historian for the entire station. A large selection of tool enhancements are available, such as InfoAgent™ for web-based data-analysis and visualization with an Internet Explorer web browser.

Condition Monitoring

Whether Kaplan, Pelton, Francis, or Bulb; vertical or horizontal; generation or pump/storage, GE can provide the right transducer, monitoring system or hydro-specific plot to deliver customized and effective condition monitoring. These Bently Nevada* products are supported by comprehensive services for installation, balancing and alignment, training, reliability, remote and onsite diagnostics, calibration and repair.

The GE Hydro Solution

GE has decades of hydro experience on rotating machinery, controls and monitoring systems. The Mark VIe Hydro Control solution reflects this experience with the most modern technology to integrate all station assets with one, flexible, networked solution for optimum performance and life-cycle cost.

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