



# EX2100e Generator Controls 35A and 120A Automatic Voltage Regulators

The EX2100e 35A and 120A Automatic Voltage Regulators (AVR) are part of the growing family of generator controls for gas, steam, and hydro turbine-generators. They are built on GE's 50 years of excitation experience with over 6,000 excitation systems installed in 70 countries. These 6,000+ systems are installed on new units, retrofits and include a wide variety of generator manufacturers.

Building upon decades of proven experience, the EX2100e incorporates the enhanced technology found in the Mark\* V1e control platform, making it a highly reliable and flexible solution.

Its flexible architecture, modern networks, and versatile software suite simplify operations and integration with plant equipment. Advanced algorithms incorporate decades of fleet experience and the latest controls technology to deliver the performance needed in today's power generation industry.

The EX2100e 35A and 120A AVRs support several excitation system applications, including brushless and rotating DC exciters, as well as SCT/PPT regulator modernizations.

## Benefits

**Increased Performance with Advanced Controls:** Provides industry-leading control, limiter, and protective functions to maximize generator performance and improve protection for a variety of applications.

**Scalable:** Two available power converters (35A and 120A DC max) allow the EX2100e AVR hardware to be optimized for most applications and budgets.

**Flexible Packaging:** Systems can be specified as a freestanding 800 mm x 800 mm (31 ½" x 31 ½") IP20 /NEMA 1 (optional IP54) panel configuration, as parts kits for custom installations or retrofits where space is a premium, saving time and money.

- **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



35A AVR

120A AVR

application software, managing block libraries, and displaying system diagnostics.

- **Latest GE software libraries** – Draws upon years of GE OEM experience to ensure safety-related software updates are delivered while also retaining the majority of the existing control system customization.
- **Built with cyber security best practices** – Controllers feature hardened network switches and HMIs within a segmented network - Achilles™ Communications Certification Level 1.
- **Expandability** – The EX2100e family of products is designed with the future in mind. The "e" architecture provides a flexible approach to life cycle management. The system is designed to allow incremental upgrades or modernization proving access to new features and protecting the investment from the rapid aging of digital component technology.

## Architecture

The heart of the EX2100e AVR is GE's patented UCSB controller. The UCSB controller incorporates modern system-on-chip (SOC) architecture. The controller uses secure Ethernet based communications to provide data to operator workstations (HMIs) or to other GE Mark VIe controllers. Other communication protocols such as Modbus (Serial or TCP/IP) can be used to communicate with non-GE DCS systems.

The 35A and 120A power converters utilize a DC link and insulated gate bipolar transistors (IGBTs) to modulate the AVR output for precise generator control from a wide variety of input sources. These sources include a single- or three-phase permanent magnet generator (PMG), a single- or three-phase AC source with power potential transformer or a 125 V DC or 250 V DC battery. The EX2100e AVR supports redundant AC and DC power input to maximize system reliability.

The EX2100e AVRs are available in simplex or fully redundant dual configurations to provide cost-effective solutions to meet the needs of any application. GE's advance dual control technology combines redundant controllers, power supplies, fans and power converters with a sophisticated virtual system model to provide unequalled selectivity and fault tolerance for a dual system (patent pending). Software packages

The ControlST\* software suite comprises several high performance tools for ease of use by operators and maintenance personnel. These include the WorkstationST\* software for management of HMI and Historian functions, the ToolboxST\* application for configuration and diagnostics, and a CIMPLICITY graphics user interface. Seamless integration provides direct connectivity from parameters on operator screens to their corresponding alarm history, trends, logic diagrams, watch windows, and browsers.

Software tools include system diagrams with signal flow, sequencing, and regulator control in the excitation control. The diagrams display variables and their values in real time. Parameters shown in the diagrams can be modified.

The flexible communication architecture enables connectivity to other GE and non-GE plant control systems through standard protocols and processes.

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## Cyber Security

Upgrading to GE's e-technology suite of products allows you to take advantage of GE's cyber security solutions, helping reduce your risk. Our cyber security solution provides defense-in-depth protection. Our solutions have undergone strict cyber security best practices demonstrating to customers that systems are developed and implemented securely. The SecurityST 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.

## Dedicated Excitation Retrofit Experts

GE provides a full range of services and support capabilities for the EX2100e excitation systems:

- Hardware, software and integration engineering
- Application expertise to support custom solutions
- Installation design and documentation packages
- Single point system responsibility – PPT, cable, bus, networks, enclosures
- Comprehensive PSS and Modeling services and documentation
- Project management, installation and commissioning services
- Nuclear grade retrofit packages and DCN support

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