



# EX2100e Excitation Control 35A Brushless Regulator

The EX2100e Brushless Regulator is a member of GE's Mark<sup>®</sup> VIe controls family for gas turbine, steam turbine, and balance of plant applications. It builds on the EX2100 experience of 2,000 units in gas, steam, and hydro applications and GE's 50 years of experience with more than 6,000 excitation systems in 70 countries. The "e" designates enhanced technology with a new controller and ControlST<sup>®</sup> software suite from the Mark VIe control product family. For reliability, the same proven control and protection algorithms are retained from the EX2100 along with its power conversion modules, which are available in simplex and dual redundant configurations.

## Architecture

The regulator control consists of one or two (redundant) single-board controllers and Ethernet communications architecture for interfacing with operator/maintenance stations and additional I/O communications.

The power conversion components include a control input section, a dc link, and the converter output with insulated gate bipolar transistors (IGBTs) to modulate the dc link source voltage to its final value. The output is fed to the exciter field as a regulated voltage or current, and an output shunt is used to monitor the field current.

Rating (for Brushless Regulator applications):

- Input voltage: 90–280 Vrms, 3-phase
- Input frequency: 480 Hz maximum from PMG
- Backup input: 125–250 V dc (to 3-phase diode bridge output)
- Output current: 35 A dc maximum
- Output forcing: 150% for 10 seconds
- Accuracy:  $\pm 0.25\%$  over operating temperature range

### Limiters

- Volts per hertz
- Over (OEL) and under (UEL) excitation
- Stator current (SCL)
- Manual restrictive

### Protection

- Volts per hertz, dual level (24EX)
- Loss of excitation (40EX)
- Bridge ac voltage phase unbalance (47EX)
- Generator overvoltage (59EX)
- Off/online overexcitation (76EX)



*Brushless Regulator Cabinet*

### Cabinet Specifications

- Protection: IP20 (NEMA 1), IP54 option
- Dimensions: 800 mm W x 800 mm D x 2286 mm H (31.5" W x 31.5" D x 90.0" H)
- Weight: 428 kg (943 lb)
- Access: Front only
- Cable access: Top and bottom
- Paint: ANSI-70 (light gray) standard, others available
- Ambient temperature: 0 to 40°C (32 to 104 °F)

## Networks and Communications

The EX2100e control communicates on the same Ethernet network as Mark VIe turbine controls. Data is exchanged peer-to-peer between control systems for functions such as VAR/power factor control to simplify plant interconnections. Alarm/event management tools are shared on the networks with high-resolution time tags, including 1 ms sequence of events reporting.

A network timeserver can be provided for time synchronization to a local time source or a global positioning satellite. This is available with  $\pm 1$  ms time accuracy between a controller and a time source, and  $\pm 2$  ms time coherence between control systems.

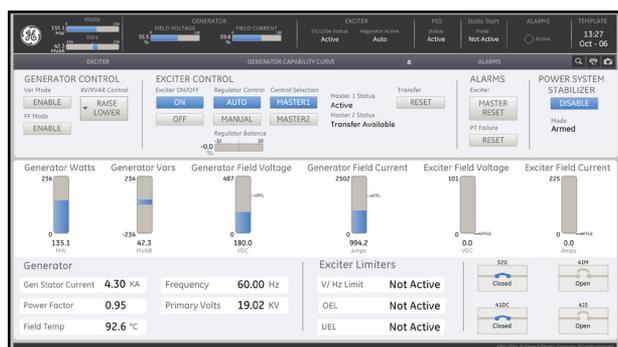
For communication to a third-party distributed control system, OPC<sup>®</sup> Data Access (DA) and OPC Alarms and Events (AE) are commonly provided and Modbus<sup>®</sup> protocol is also available.

## Human-machine Interface (HMI)

GE's Human Machine Interface (HMI) enables a more efficient and productive window into your operations, providing the intelligence that operators and maintenance technicians need to maintain and improve the productivity of assets in the plant. These solutions provide benefits that focus on improving the productivity and performance of your operations. Whether you are looking for enhanced trending capability with our Historian and TrenderST packages or looking to improve the effectiveness of your operators with our latest HMI technology, GE can customize our software to meet your needs.

### Door Mounted Operator Interface Options

The EX2100e can be equipped with one of two optional, door mounted, touchscreen operator interfaces, both with password protection. Cost effective, basic operational control and monitoring functions are available via the 6" color Local Keypad - Monitoring & Diagnostics (LKMD).



Door Mounted Touchscreen

Owners may also select the full featured GraphEX-OI Operator Interface (GOI) as an option. The 15.6 inch GOI provides intuitive control and monitoring of the excitation system, including generator capability curve and alarm management windows. Based on GE's most advanced HMI product, it provides modern gray-scale data visualization, simplifying data presentation and clarity. Operator effectiveness is increased via improved situational awareness and faster response to system events. The GOI can be mounted locally on the EX2100e door or remotely as a primary or secondary operator station.

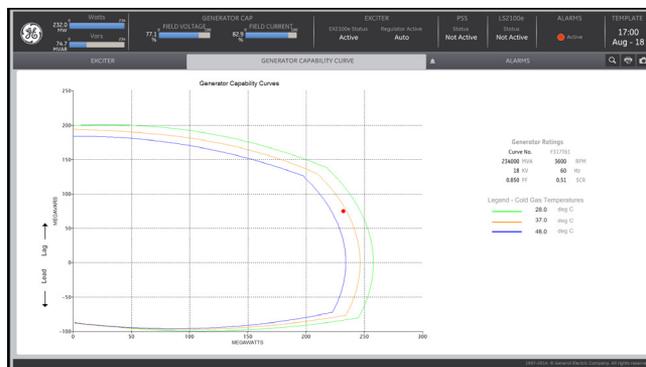
### Software Packages

The ControlST software suite comprises several high performance tools for ease of use by operators and maintenance personnel. These include the WorkstationST\* application for management of HMI and Historian functions, the ToolboxST\* application for

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User Friendly Software Tools with System Configuration

configuration and diagnostics, and a CIMPLICITY\* graphics package. Seamless integration of these tools provides direct connectivity from parameters on operator screens to their corresponding alarm history, trends, logic diagrams, watch windows, and browsers.

## References

For additional information, reference:

- GEI-100784, EX2100e 35A Regulator Control Product Description
- GEH-6707, ToolboxST User Guide for EX2100e
- GEH-6781, EX2100e Excitation Control User Guide

## Benefits

- Enhanced reliability with redundant controls and protection
- Better availability with improved diagnostics and online repair in redundant systems
- Improved performance with advanced algorithms such as Power System Stabilizer (PSS)
- Enhanced operability and maintenance with a versatile software suite
- Reduced life-cycle cost with a common architecture, networks and software suite with turbine and plant controls

## Conclusion

The EX2100e excitation control is a highly reliable control, protection, and monitoring system. 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.

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