GE Energy

EX2100e Excitation Control for Gas Turbine Generators

fact sheet

The EX2100e excitation control is GE Energy's advanced platform for generator excitation systems. EX2100e builds on the EX2100 experience of over 700 units in gas, steam, and hydro applications for new units and upgrades, in addition to GE's 40 years of experience with over 6,000 excitation systems in 70 countries.

The "e" designates enhanced technology with a new controller from the Mark* VIe controller family and ControlST* software suite for commonality with GE's family of plant control systems. In addition, the EX2100e offers a brushless dual redundant regulator option for cost effective reliability.

Architecture

The system consists of one or multiple controllers, a protection module, power conversion bridges, and the power magnetics / transformers. Typical functions performed in the controller and protection system include:

Control

- Automatic voltage regulator
  - Reactive current compensator
  - Volts per hertz limiter
  - Overexcitation limiter
  - Underexcitation limiter
- Manual field voltage regulator

Protection

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

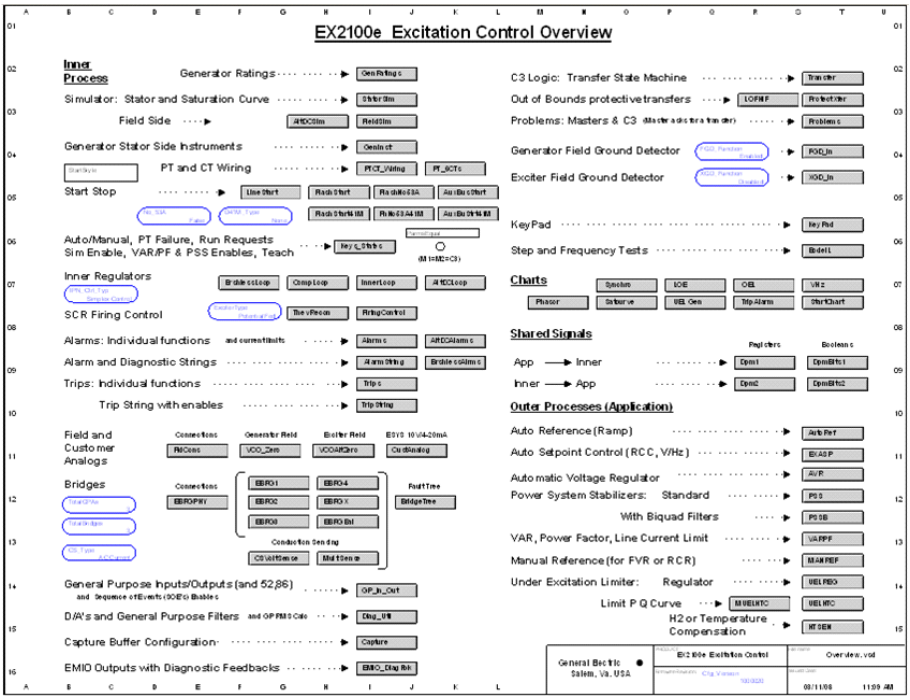
The software can also include the power system stabilizer (PSS). This enables the generator to produce and transmit more power in a stable manner by reducing low frequency rotor oscillations. Power system studies are available to optimize the tuning of the stabilizer for the best performance. These studies include computer simulations for transient stability analysis. Field testing services are also available for commissioning to verify and document system performance to existing specifications.

Redundancy

Gas turbine-generators (7 and 9FA, FB, and H class) have potential source (bus fed) static excitation controls with power potential transformers to step down the bus voltage to a suitable voltage for the excitation controls. These controls are normally supplied with either a full multi-bridge or a warm backup for redundancy to maximize system reliability. Redundant controls include online repair capability for circuit boards and power supplies. Multi-bridge units can support online repair of the power conversion bridges. Units with redundant rectifier cooling fans can also be replaced online to support equipment availability.

MS6001B, 6001FA, 7001EA, and 9001E gas turbine generators usually have brushless excitation controls with an ac-rotating generator connected to the shaft of the main generator. These units are equipped with EX2100e excitation control brushless regulators. They are normally supplied as simplex, non-redundant, control systems, but are also available in warm backup configuration for redundancy. They share the same overall control design and software features as static exciter systems for consistency. Gas turbines contain:

Turbine	System Type	Redundancy
MS9001H MS7001H MS9001FB MS7001FB MS9001FA MS7001FA	Potential source static exciter	Multi-bridge
MS9001E MS7001EA MS6001FA MS6001B	Brushless regulator (typical)	Simplex and warm backup option



Software Tools with System Diagrams

Networks and Communications

The EX2100e excitation control communicates on the same 10/100 Mbps Ethernet network as Mark Ve, Mark VI, and Mark VIe turbine controls, and the LS2100 / LS2100e Static Starter. 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 ±1 ms time accuracy between a controller and a time source, and ±2 ms time coherence between control systems.

If a third party supplies the Distributed Control System (DCS), the local GE controls typically communicate using OPC®, Modbus®, or GE Standard Messaging (GSM) protocols. All three protocols support full operation and monitoring of the controls from the DCS, but only OPC and GSM provide local high-resolution time tags. If a Mark VIe Integrated Control System (ICS) is supplied for the DCS, then IEC 60870-5 and DNP 3.0 protocols are also frequently provided.

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.

Benefits

- Maximum reliability with redundant control and protection
- Better availability with improved diagnostics and online repair
- Improved performance with advanced algorithms, such as power system stabilizer
- Enhanced operability and maintenance with a versatile software suite
- Reduced life-cycle support with a common architecture, networks, and software suite

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-level controls. Advanced algorithms incorporate decades of fleet experience and the latest controls technology to deliver the performance needed in today's power generation industry.

For further assistance or technical information, contact the nearest GE Sales or Service Office, or an authorized GE Sales Representative.

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