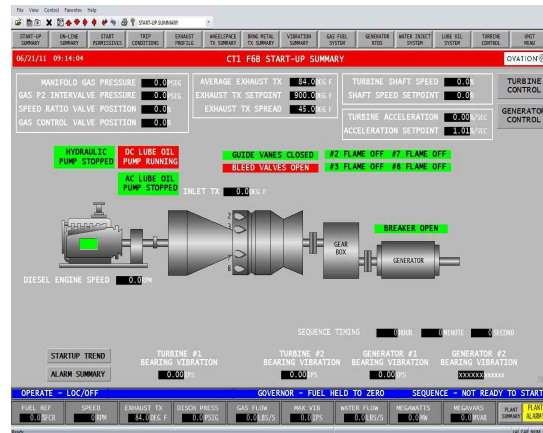


Features

- Provides quick and efficient access to important turbine control information
- Increases reliability with a proven track record of 99% availability
- Accurate spread monitoring of all exhaust temperatures
- Tighter control of turbine acceleration and temperature
- Reduces downtime through improved information troubleshooting
- Fast isolation of problems through descriptive alarms, reducing likelihood of catastrophic failures



Innovative Gas Turbine Control Solutions

For more than 50 years, Emerson Process Management (Emerson) has been an industry leader in turbine control. Today, as older turbines operate beyond their original life expectancy, better control is a necessity. Emerson's gas turbine solutions use state-of-the-art Ovation® technology to give today's utilities the most flexible, powerful control system available.

We have a long history of retrofitting various turbine types from leading manufacturers including:

- Alstom (ABB/BBC)
- General Electric (Frame and LM)
- Pratt & Whitney
- Siemens
- Ruston
- Solar
- Westinghouse (all models)

Gas turbine control systems replaced:

- Westinghouse P50/G50
- General Electric Speedtronic Mark I, II, III, IV, V & VI
- General Electric Fanuc PLC
- Allen Bradley PLC

- General Electric Fuel Regulator
- Woodward Governor
- Many others

Through more than five decades of experience, we have developed a solution that incorporates all the design and operational knowledge proven in previous systems, while adding improved reliability and availability through enhanced technology. By working above normal standards of turbine control, we have created a system that maximizes the life of today's turbines.

Our Solution – Your Benefits

Along with reliable, efficient turbine control, Emerson offers a total combustion turbine solution that comes with added benefits:

Ease of operation through quick and efficient access to nearly twice the visual information as is available on older control panels. Data now available includes:

- Active control/mode type
- Indication of when turbine acceleration is passing through vibration criticality
- Text prompts of critical milestone check with time remaining during startup
- Indication of “startup probability” prior to startup

- Elapsed startup time
- Display of selected group of system parameters
- All exhaust temperatures along with temperature spread presented in a single graphic

Increased reliability by way of redundant systems and proven Ovation technology. Redundant Controllers and power supplies ensure continuous control and monitoring of your gas turbine operations.

Accurate spread monitoring through continuous examination of all exhaust temperatures. Temperature spreads displayed at the engineer/operator workstation allows an operator to more accurately monitor spread conditions and immediately act if a problem occurs.

Tighter startup control of acceleration and temperature allow quicker starts of your gas turbines in a more efficient manner.

Descriptive alarms visible through the engineer/operator workstation allow your operators to monitor turbine activities and respond to problematic conditions.

Preventive maintenance is provided through trending of important turbine information and long-term storage of that data. For example fast or slow temperature changes can be seen through trending screens, thus indicating nozzle problems. Quick operator action at this point will prevent future maintenance and possibly equipment failure.

Built on a Solid Foundation

Revolutionary Ovation technology is the basis for Emerson's gas turbine control solution. Compatible Ovation building blocks allow for flexible combination of various components and subsystems to match specific plant configurations. Ovation's built in redundancy and self-diagnostics increases reliability, reducing expensive system downtime. A broad range of subsystems, each designed for specific applications, are used to create our gas turbine controls. Applications include

process control, data retrieval, general-purpose computation and man-machine interface. All subsystems are linked together by the powerful Ovation Network. An operator/engineer workstation provides a high-resolution window to the process for control graphics, diagnostics, trending, alarms, and plant status displays. Engineering functions are performed through powerful tools to configure and maintain the Ovation control system. Combining functions within a single workstation reduces equipment costs, spare parts, and space requirements.

The Ovation Controller executes simple or complex modulating and sequential gas turbine control strategies, as well as performs data acquisition functions. Redundant 120VAC or 125 VDC power supplies are used for both control processor and I/O power. Field redundancy is provided through multiple sensors and controls interfaced to separate I/O circuits within the controller. The controller is mounted in a customized enclosure, designed to house other devices such as vibration monitors, UV flame detection, counters and timers, synchronizer, and local controls.

Controlling Your Gas Turbines

Our vast experience in the power generation industry has given us many opportunities to work with gas turbine control systems from various manufacturers. Our control philosophy for each solution centers on efficient operation, reliability, and safety. Regardless of the turbine control supplier, our retrofit solution offers secure turbine shutdown through reduced generator load at a safe designated rate. When minimum load is reached, the generator breaker is opened and the turbine is cooled down by being held at synchronous speed. After the cool down period, all fuel valves (throttling and isolation) are closed while the turbine coasts to a stop and the turning gear is engaged. Turbine protection is provided through alarms for less severe faults and automatic control for directing current operation from dangerous maneuvers to a safe condition. Control and data acquisition functions for specific control systems are highlighted below.

Westinghouse P50/G50 Retrofits

In the early 1960s, Westinghouse developed the P50, one of the first mini-computers for use in electric utility turbine control. As Emerson, our current turbine control solution can replace this antiquated technology. The Ovation system automatically controls the turbine from turning gear to base load operation with a single operator action. Graphics allow the operator to control turbine speed, load, startup load targets and rates, load increases, and temperature. Typical hardware provided for a Westinghouse P50/G50 upgrade includes:

Component	Quantity
Ovation Controller	1
Ovation I/O System	
• AI	15
• RTD	2
• AO	2
• DI	1
• Contact Input	7
• DO	4
• Speed Sensor	2
Ovation Engineer/Operator Console	1
Network Interface Equipment	1
System Configuration including hardware, database, control and graphics implementation	1
Local Panel with:	
• Synchronization insert	
• Auto synchronizer	
• Remounting of vibration monitoring	
• Remounting of flame detectors	

General Electric Speedtronic and Fuel Regulator Retrofits

Emerson's solution for retrofitting General Electric Speedtronic and Fuel Regulator includes control of speed, load, exhaust temperature, and SRV valves. Turbine protection controls are provided for overspeed, over temperature, high vibration, loss of flame, low lube oil pressure, and high lube oil temperature. Exhaust temperatures are monitored to detect significant combustion temperature imbalance. If the temperature

disparity is great, then the Emerson system will trip the unit or runback load.

Emerson gas turbine controls manages turbine actions from ratchet sequence to base load operation. Selectable load targets are one method of controlling turbine operation from startup. Another is using the base/peak/peak reserve control mode until the desired load point is reached, then selecting MW control. Turbine shutdown is initiated with a single push button from the engineer/operator workstation. "Normal Stop" reduces generator load at a rate designated by the operator. When minimum load is reached, the generator breaker is opened and a soft shutdown sequence is initiated. This method minimizes shock to the turbine. After the cool down period, all fuel valves are closed as the turbine coasts to a stop, at which time ratchet sequencing begins. "Normal Stop" can be cleared at any time prior to flame out.

A fuel servo interface module is provided to monitor valve demand and position signals for system performance and protection. Fuel regulator conversion is performed by an I/H interface in the Ovation Controller. Typical hardware provided for a GE Speedtronic and Fuel Regulator upgrade includes:

Component	Quantity
Ovation Controller	1
Ovation I/O System	
▪ AI	8
▪ RTD	3
▪ AO	2
▪ DI	7
▪ DO	4
▪ Speed Sensor	5
▪ Fuel Servo Interface	2
Ovation Engineer/Operator Console	1
Network Interface Equipment	1
System Configuration including hardware, database, control and graphics implementation	1
Vibration amplifiers and transducers	3
Auto synchronizer	1
Megawatt/Megavar/Voltage transducer	1

Compressor discharge transducer	1
Interstage pressure transducer	1
I/H panel assembly	1
4-20ma I/O assembly	1

Woodward Governor Retrofit for W501

Emerson's retrofit solution for replacing Woodward Governor controls on a Westinghouse 501 turbine is similar to our Westinghouse P50/G50 solution. The Ovation system automatically controls the turbine from turning gear to base load operation with a single operator action. Graphics allow the operator to control turbine speed, load, startup load targets and rates, load increases, and temperature. Typical hardware provided for a Woodward Governor upgrade includes:

Component	Quantity
Ovation Controller	1
Ovation I/O System	
▪ AI	14
▪ RTD	5
▪ AO	2
▪ DI	1
▪ Contact Input	7
▪ DO	4
▪ Speed Sensor	2
Ovation Engineer/Operator Console	1
Network Interface Equipment	1
System Configuration including hardware, database, control and graphics implementation	1
Local Panel with:	1
▪ Synchronization insert	
▪ Auto synchronizer	
▪ Remounting of vibration monitoring	
▪ Remounting of flame detectors	

- Historical storage and report capabilities can be incorporated by adding software to the Engineer/Operator workstation
- Sequence of events can be added to the system, as an integral feature of an Ovation Digital I/O module. SOE points are time tagged to the 1/8 millisecond
- Demolition and installation is available for removal of your existing turbine control system and installation of Ovation
- Remote control capabilities are available through either direct wiring or data communications through a communication server
- Performance calculations can be provided for individual turbine efficiency and total plant efficiency
- Load management provides information to the operators for putting on or taking off individual turbines in response to load changes. The least efficient turbine is removed first, with the remaining turbines being the most productive.
- Interfaces to multiple third party devices servicing the gas turbine are available. Interfaces for PLCs, RTUs, analyzers, vibration monitoring systems, recorders, DEC, IBS etc. are via RS-232 or 485 data links.

Turbine Control Options

Several options are available to further enhance your Emerson Gas Turbine Control solution.

- Alarm printer for color hard copies of system alarms