

Ovation™ P&W FT8® Control System Retrofit

Features

- Fully engineered and field-proven retrofit for Pratt & Whitney® (P&W, PW Power Systems Inc.) FT8® gas turbines equipped with legacy Woodward MicroNet™ and NetCon™ control systems
- User-friendly tools and direct access to turbine logic facilitates in-house maintenance and reduces dependence on specialist support
- Ovation-based solution with powerful redundant processors specifically designed to meet the critical needs of FT8 gas turbines
- Incorporates best practices and control enhancements that enable:
 - Better operator decision making
 - Improved unit operation, performance and starting reliability
 - Simplified troubleshooting and maintenance
- Comprehensive suite of integrated products and services to support cybersecurity programs and obligations
- Flexible architecture easily integrates turbine and balance-of-plant systems including demineralizers, chillers and gas compressors for unified plant control
- Options available for generator excitation, vibration prediction, instrumentation upgrades, wireless monitoring and simulation



Legacy Control Challenges

Pratt & Whitney FT8 gas aero-derivative turbines are popular for use in peaking and fast start applications. Many of the FT8 turbines installed in the early 1990's through the 2000's operate with Woodward MicroNet or NetCon control systems. These systems now face support and obsolescence issues where spare parts and service can be costly and difficult to obtain. Additionally, locked logic make it difficult for users to self-maintain or troubleshoot the system.

Ovation™ P&W FT8 Control Retrofit

Emerson offers a fully engineered and field-proven packaged retrofit for Woodward MicroNet and NetCon control systems on FT8 gas turbines packaged by Pratt & Whitney's Turbo Power & Marine division. The solution is based on Ovation gas turbine controls as a 'drop-in' replacement for the Woodward systems on water injected or DLN FT8 machines.

Emerson's comprehensive retrofit program for the FT8 fleet encompasses turbine control development and application enhancements, project specific content, installation and commissioning as well as providing FT8 application lifecycle support and updates.

Ovation FT8 Control Retrofit Application

The Ovation FT8 retrofit solution replaces the legacy Woodward systems while incorporating new control enhancements for reliable, flexible and safer turbine operation. Ovation provides the basis for a fully integrated FT8 control system that includes all governor and sequencer turbine controls. Balance-of-plant control can be easily added based on customer requirements.

A typical Ovation architecture for an FT8 unit includes a redundant fast Ethernet-based network and a redundant controller with associated I/O modules for governor, sequencer and auxiliary control. A local gas turbine workstation is also provided for domain control, engineering and operations.

The Ovation retrofit includes all native I/O modules that directly interface the Ovation system to speed detectors, LVDTs, servo-valves and other turbine instruments. Ovation's direct communication with turbine instruments avoids the use of external signal conditioners, provides detailed diagnostics down to I/O level and ensures fully integrated control of all turbine systems including:

- Variable geometry – VIGV or VSV actuators
- Fuel systems – gasⁱ and liquidⁱⁱ
- DLN gas valves
- Water injection system
- Hydraulic starter system
- Turbine & generator lube oil systems
- Thrust balance system
- Chip detection system
- Vibration monitoring – engine & generator sensors
- Combustion dynamic monitoring
- Generator temperature monitoring
- Auxiliary systems

Replaced Legacy Components

The Ovation FT8 retrofit solution covers the replacement of all legacy Woodward equipment and HMI systems as well as other special devices where applicable, while retaining the existing field wiring and turbine instrumentation. The following components are replaced during an Ovation FT8 control upgrade:

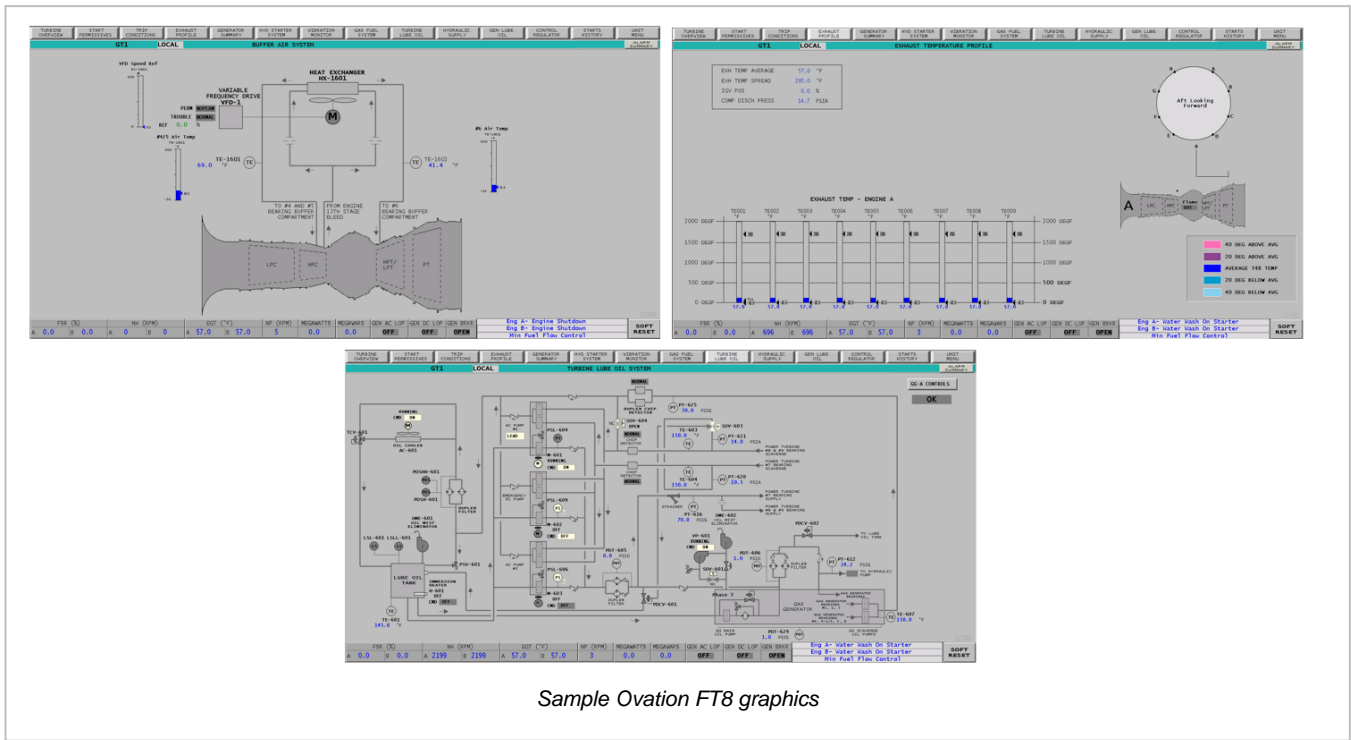
- Woodward MicroNet or NetCon turbine controller
- Optional Woodward MicroNet or NetCon BOP controller
- Woodward LINKnet distributed IO
- Power monitor
- HMI and embedded application (Citech®)

Engineering workstations and programming tools – Woodward and HMI

Optional Upgrades & Enhancements

Emerson offers wide range of complimentary modules to provide a comprehensive solution for your unit including:

- Integrated balance-of-plant control
- Connectivity to other Ovation system networks within the unit, plant or fleet to optimize dispatch or generation
- Starting reliability check routine
- Electronic overspeed upgrade (SIL-rated)
- Remote start and 10 minute fast start
- Gas fuel flow measurement upgrade; provides accurate compensated flow measurement for use in the control system as the basis for NOx water flow schedule
- Ovation Security Center (OSC) that provides higher levels of NERC-CIP security compliance
- Generator control, protection and excitation
- Fuel system or fuel valve upgrades
- Instrumentation and control valve upgrades
- Additional monitoring instrumentation including a full range of wireless instruments that reduce installation time and cost
- Additional workstations for remote operations and historical functions
- Simulation for control validation and operator training



Benefits of an Ovation FT8 Control System Retrofit

Benefit	Ovation Enhancement
Enhanced operator decision making	<ul style="list-style-type: none"> ▪ Unit operation maintenance summary that calculates factored hours/starts ▪ Smart dashboard displays start and trip data as well as gross, net and auxiliary megawatt-hours for each run ▪ Automatic turbine trip reports provided by the Ovation Process Historian ▪ Enhanced exhaust display includes color-coded tabular views of combustion data ▪ Generator capability monitor shows capability curve with automatic alarming outside of generator limits
Improved unit operation and performance	<ul style="list-style-type: none"> ▪ Unit start profile that compares startup and coast-down times with a baseline to identify blade tip rub and other issues ▪ Gas turbine performance indicator that includes megawatt capability predictions as well as real-time heat rate and efficiency calculations ▪ Manual synchronization from the operator workstation ▪ Manual bias of water injection for improved NO_x control ▪ Automatic droop tests and frequency response
Simplified troubleshooting and maintenance	<ul style="list-style-type: none"> ▪ Dedicated start permissives and trip displays enable fast problem identification ▪ High-speed trending to pinpoint event data ▪ Overspeed testing from HMI ▪ Fuel valve calibration from HMI ▪ Monitoring of 125VDC battery voltage and cell condition

One Platform for Integrated BOP Control

Most FT8 units include balance-of-plant controls for auxiliary systems such as demineralizers, inlet chillers, SCRs, water systems, gas compressors and the electrical yard. The Ovation platform is perfectly suited for all combined cycle and BOP controls. Controlling the entire power block using a single unified automation platform not only helps enhance reliability, but also provides further opportunities for operational improvement such as increased plant efficiencies and megawatt production, and long-term operation and maintenance savings.

Ovation - Designed for Power

The foundation of Emerson's FT8 gas turbine control solution is Ovation technology. Ovation was designed to:

- **Eliminate obsolescence concerns** by using commercially available technology.
- **Provide intuitive built-in diagnostics** that enables quick problem identification.
- **Secure operations** with standard features that address cybersecurity concerns.
- **Simplify configuration and maintenance** with integrated user-friendly engineering tools.

Summary

Emerson understands the changing dynamics of the power industry and stands ready to apply our expansive portfolio of solutions to help increase performance and reliability of GE turbines.

The Ovation FT8 control retrofit program was developed by Emerson's dedicated gas turbine solutions group that includes highly specialized experts with years of experience designing, implementing and supporting turbine controls from every major OEM including GE, Westinghouse, Siemens, ABB, Pratt & Whitney, Solar, Rolls Royce and more. An integral part of the program is Emerson's commitment to long-term product

support and cost-effective migration paths that reduce lifecycle costs while keeping pace with technological advancements.

i – ii: Interface to Woodward hydraulically actuated valves with high current servos may require an amplifier. Woodward electric actuated valve drivers can be retained or upgraded.

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