

GE
Oil & Gas

Integrated Turbine-Compressor Control



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Maximize your turbo-machinery and process reliability and efficiency with GE's Oil & Gas integrated control solution for turbines and compressors.

The GE Integrated Turbine-Compressor Control (ITCC) system is the OEM solution designed to provide complete integrated control, protection and monitoring for optimum protection of the compressor from harmful surge conditions, while enhancing the process system efficiency and availability.

It is already installed on more than 150 Turbine-Compressor units in operation worldwide.

This integrated control solution provides critical process control for the entire turbine and compressor train, its auxiliaries and related process equipment. Compatible with a variety of turbines and compressors, ITCC runs on the GE Mark family of control platforms and on GE Fanuc PLC's for new or retrofit applications.



Significantly Improved Compressor Station Efficiency & Reliability

ITCC is a fully digital control that delivers enhanced machinery performance. The independent actions of separate turbine and compressor controls can adversely impact the process, and in turn, diminish the overall efficiency of the machinery. By integrating the compressor and turbine controls into one common system, the GE ITCC can optimize performance and maintain the necessary degree of reliability.

The ITCC simplifies operations and provides more accurate operating data faster. By providing access to a variety of types of data through a common database, ITCC streamlines the monitoring and control process and helps to enhance compressor function and pipeline and process stability. The system is password protected and fully programmable using function blocks and ladder diagrams, and has extensive block libraries to further simplify setup. The control system can support remote I/O and hazardous area installations as an option.

Benefits

- Comprehensive, integrated control for an entire turbine-compressor train
- Applicable to a variety of turbines and compressors and able to run on GE control hardware
- Compatible with single- or multi-stage compressor systems
- Highly reliable – less electronics, less opportunity for single point failures
- Easy to use – access to all process data from a single database
- Upgradeable as turbine and compressor enhancements become available
- Advanced diagnostics for quick location of process faults
- Fewer spare parts needed – one control platform, multifunction I/O boards



Main Features

The Mark VI Family

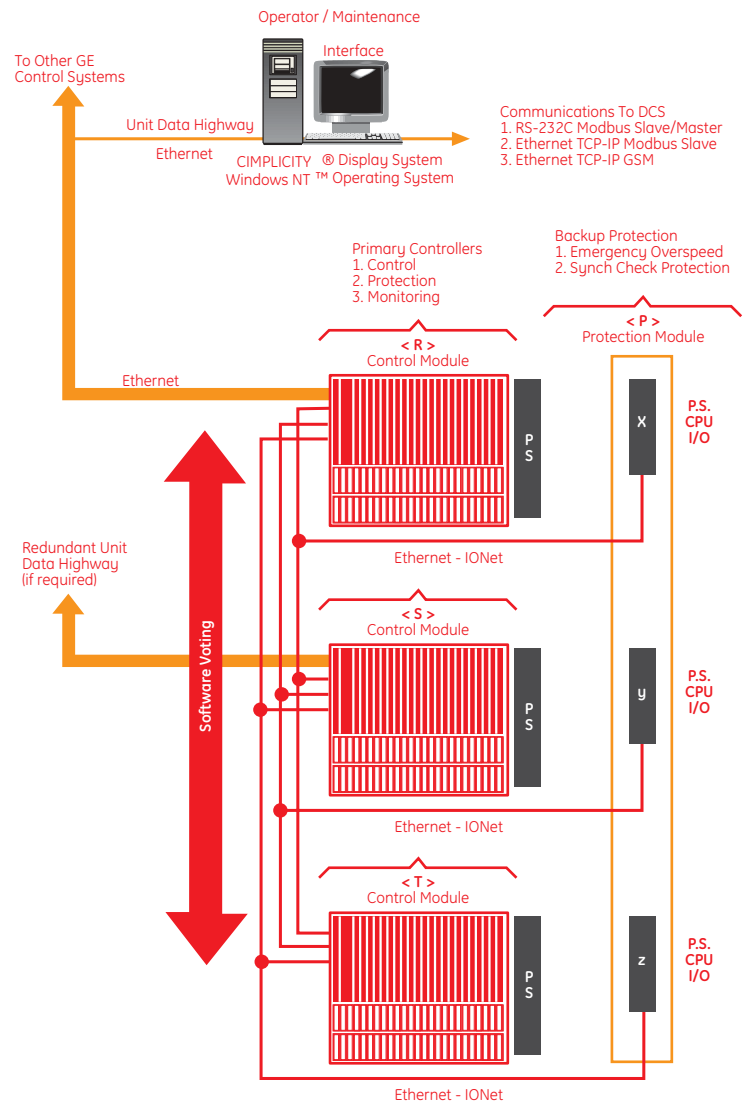
GE has a heritage of over 30 years of successful operation of electronic turbine control systems. The SPEEDTRONIC™ Mark VI turbine control system is the current state-of-the-art control for GE turbines. It is designed as a complete integrated control, protection, and monitoring system for generator and mechanical drive applications of gas turbines and steam turbines.

Architecture

Various control system redundancy options are available with Mark VI (Simplex or TMR) or Mark VIe (Simplex, Dual, TMR) for both small applications and large integrated systems. The diagram on the following page illustrates a typical Mark VI TMR configuration. A Simplex configuration would not have the <S> and <T> control modules. The Simplex <R> control module is also available in a dual redundant power supply configuration.

I/O Interface

- General Purpose I/O
 - Discrete I/O
 - Analog I/O
 - Temperature Monitoring
- Application Specific I/O
 - Speed (Pulse Rate) Inputs
 - Flame Detection
 - Servo Valve Interface
 - Vibration / Proximitors Inputs
 - Dynamic Pressure Inputs



Operator Interface

The operator interface is commonly referred to as the Human-Machine Interface (HMI).

It is a PC with a Microsoft® Windows® operating system supporting client/server capability, a CIMPLICITY® graphics display system, a Control System Toolbox for maintenance, and a software interface for the Mark VI and other control systems on the network. It can be applied as:

- Primary operator interface for one or multiple units
- Gateway for communication links to other systems
- Maintenance station
- Engineer's workstation

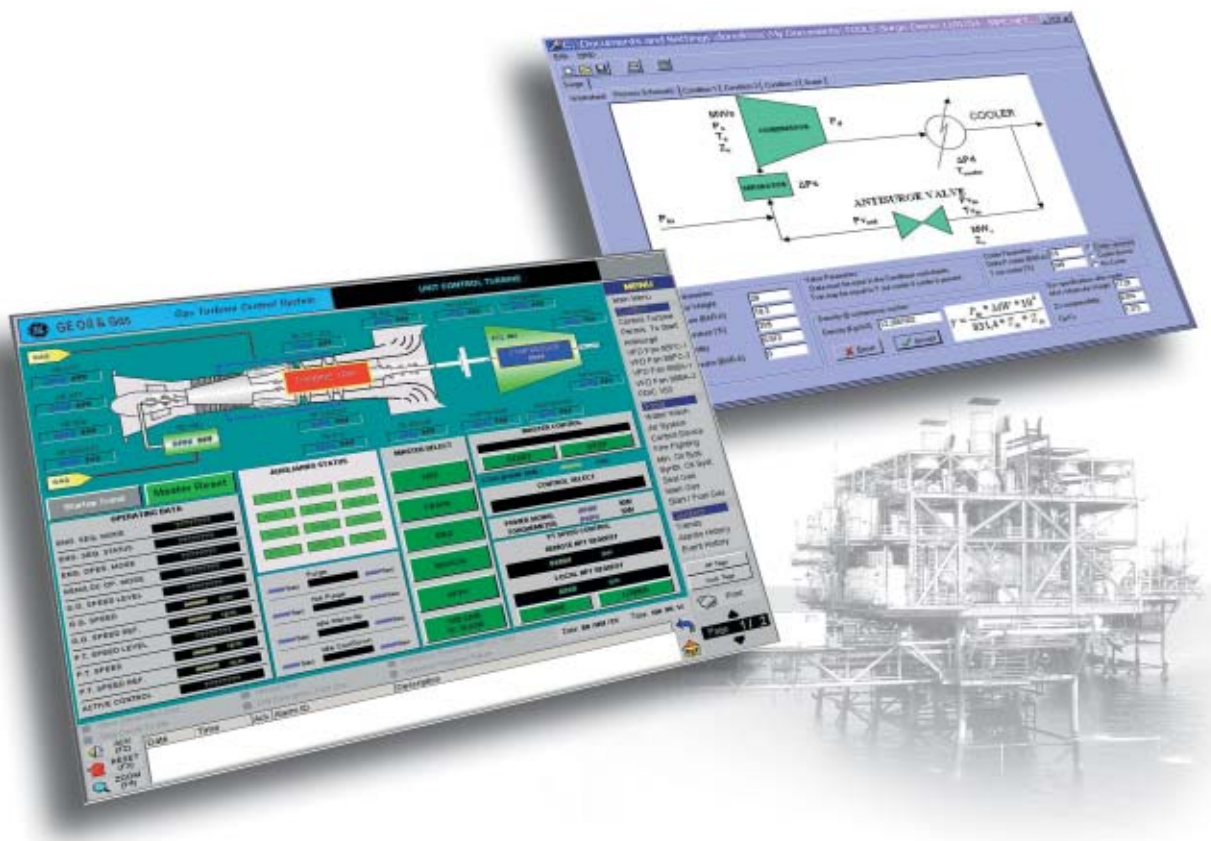
System (process) alarms and diagnostic alarms for fault conditions are time tagged at frame rate (10/20/40 ms) in the Mark VI control and transmitted to the HMI alarm management system.

Software Maintenance Tools

The Mark VI is a fully programmable control system. Application software is created from in-house software automation tools that select proven GE control and protection algorithms and integrate them with the I/O, sequencing, and displays for each application.

Software frame rates of 10, 20, and 40 ms are supported. This is the elapsed time that it takes to read inputs, condition the inputs, execute the application software, and send outputs. Changes to the application software can be made with password protection (5 levels) and downloaded to the control module while the process is running.

Online diagnostics simplifies troubleshooting and helps isolate faults quickly, while "plug-and-play" I/O boards speed repairs for minimized mean time to repair.



Turbocompressor Control Application

The Mark VI / Mark VIe controllers and GE Fanuc PLC's can integrate in one common platform all the sequencing, controls and protection functions that are necessary to provide coordinated and safe operation of a turbocompressor unit.

This capability typically includes:

- Gas turbine and associated auxiliaries control and protection
- Centrifugal compressor anti-surge control
- Centrifugal compressor load sharing control
- Centrifugal compressor dry gas seals control
- Process valve sequencing
- Process gas cooler control
- Process gas scrubber level control

These control algorithms have been developed based on our extensive knowledge of centrifugal compressors and their applications and have seen widespread, successful use.

In particular, the compression unit operating parameters are displayed and accessed through the HMI. The following information

is available:

- Display of the process variables, set point, output response and status of each anti-surge control loop
- Display of the performance curve for each compressor stage along with the configured Surge Limit Line. The operating point of the compressor is also displayed in the screen.
- Display of real-time trending of process and calculated anti-surge variables. Trends are initiated manually and automatically stored by the HMI Historian.
- Display of anti-surge related alarms with time stamp as part of the turbocompressor unit alarms.
- Display of the real time process trends and variables (calculated by the Mark VI. Calculations are automatically triggered by an event and a configurable number of data samples prior to and after the event are stored).
- Selection and playback of the recorded files by the HMI Historian.



Advantages:

Combining turbine and load compressor control in a single platform provides numerous advantages to the end-user:

- Common spares for both turbine and compressor control systems reduces overall spares inventory requirements.
- Smaller physical footprint . Compressor control hardware can be included in the same cabinet as the turbine control hardware.
- Common software tools and diagnostics for maintenance of turbine and compressor controls. Common tools also reduce startup time and cost.
- Training time and costs are reduced with a single control system used for both turbine and compressor controls. This applies to both initial and on-going training costs for the life of the control system.
- Common HMI for gas turbine and compressor allows better data correlation for debugging and diagnostics.
- Compressor Graphic pages on unit HMI allow better understanding and management of unit operation.
- The same Technical Advisor can handle commissioning and start up of the turbocompression train.
- Eliminates negative interactions that can develop between separate compressor and turbine control systems, improving system reliability and efficiency.

Faster Response to Minimize Surge Events

Operating compressors on the verge of surge can increase process operating range and overall efficiency, but the practice also contains inherent risk. The GE integrated control system minimizes that risk utilizing proprietary algorithms, precision instrumentation, and fast-acting valves thereby enabling the compressor to be operated very close to the surge line.

Anti-surge protection for compressors not only enhances compressor train reliability and pipeline and process uptime, but it also reduces maintenance costs. By preventing machinery surge, repair and replacement hardware costs are minimized, leading to a higher return on investment.



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GE imagination at work

COMK/MARK 876/II - Designed by: Studio Tre Fasi
Printed by: Sagraf - 12-2005
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