GTC250

Aero-Derivative Gas Turbine Control

Applications

The GTC250 control can be applied to a variety of gas turbine applications. Since the hardware is flexible in terms of the onboard I/O as well as distributed I/O capability, the control can be scaled from minimal application requirements to large applications. Typical applications include:

- Generation–Base Loading, Peaking, Stand-by, Marine
- Compression–Gas Processing, Gas Production, Pipeline
- Combined Heat and Power (CHP)
- Combined Cycle (Aero-derivative) Power Generation

Description

The GTC250 control is an industrial platform that offers robust, low-cost control for a wide variety of aero-derivative gas turbine applications. Most importantly, this control is designed to be a true "network based platform" that interfaces seamlessly with a wide variety of modern communication and field bus architectures. The GTC250 couples state-of-the-art PC technology with a proven real time operating system to provide reliable and deterministic performance that is required for recursion-rate sensitive applications. Dedicated inputs and outputs (I/O) are available onboard for key control signals while distributed I/O can be used for other less critical parameters.

The modular hardware configuration lends itself to bulkhead mounting. Environmental specifications allow the GTC250 to move out of the control room and closer to the prime mover. In many cases, it can be mounted on the prime mover skid. Typically, the GTC250 is mounted in an enclosure rated for the site-specific environmental conditions.

A variety of computational and I/O signals is available to meet the specific needs of the application. Internally, the configuration of the printed circuit board stacks eliminates the need for a motherboard; reducing overall cost. Wiring terminations are provided on the top and bottom edges of the printed circuit boards by means of quick disconnect plug and socket connectors. Control power is supplied from an external 24 Vdc source.

The GTC250 contains required I/O and core fuel control software that can be configured to control two-shaft aero-derivative gas turbines. In addition to its primary purpose of basic fuel control, the unit can be programmed to provide added control functionality. Unit start sequencing, protective monitoring or other site-specific control requirements are easily accomplished by using spare onboard I/O or utilizing remote distributed I/O. Data logging files are included to facilitate troubleshooting, and non-volatile counter/timer files keep track of starts, fired hours, and other useful data. Control models are available that support Profibus or Modbus® * serial communication architecture used for remote distributed I/O.

Communications with the GTC250 control are available to program and service the control as well as to interface with other systems (Plant DCS, HMI, etc). A service interface allows the user to view and tune system variables. Several tools are available to provide this interface (See Engineering and Service Access). Communication protocols such as TCP/IP, OPC, Modbus and other current designs are included so that the user can correctly interface the control to existing or new plant level systems.

*—Modbus is a trademark of Schneider Automation Inc.

- True "Network Based" platform

- Industrial Pentium Processor

- VxWorks® Real Time Operating System

- Profibus Distributed I/O Capability

- Multiple Communications Protocols
  - ✓ Modbus®
  - ✓ Ethernet TCP/IP
  - ✓ Ethernet UDP
  - ✓ OPC (Ethernet)
  - ✓ DDE (Dynamic Data Exchange)

- Data logging files

- Non-volatile Counters & Timers file

- Low cost alternative to a general purpose PLC

- Scalable from core fuel control to total package control

- Programmable in GAP™ and Multiprog (KW Software)

- CE Compliant; Hazardous Locations

GTC250 Configuration

The GTC250 digital control system utilizes the Woodward AtlasPC control platform, and is designed to be bulkhead mounted in a control panel. The complete unit contains a packaged CPU module, a SmartCore (main) I/O module, a Power Supply module, and 3 Analog Combo modules. In addition, depending on the part number, the system can include an optional relay Field Termination Module (FTM) and/or a Profibus communications module (used for distributed I/O communications).

The GTC250 control system includes an assembled AtlasPC platform with an integrated configurable gas turbine application program. Application source code and service tools are included on an install CD for installation onto a site computer. The provided service tools are used to configure the GTC250 control's core fuel control algorithms to the specific application. The provided source code can be used with Woodward's GAP program to add site-specific logic.

High Performance On-board I/O
GTC250 on-board I/O is optimized for prime mover and load control
- High Speed and deterministic update times
- High CMRR and control-specific filtering result in high degree of noise immunity
- 15 bit resolution differential inputs, allowing very precise control
- I/O is accurate across temperature range
- I/O is isolated in groups to prevent ground loops and other induced noise issues

Programming and Simulation

The GTC250 control makes use of the same powerful and proven tools used by all of Woodward's PC control systems. The GTC250 is field programmable, allowing site engineers to configure the control to their specific application and make future control configuration changes. On-line program adjustments are available to allow program refinements while a unit is running. Inputs and outputs are configurable as required by the application or interface.

Woodward's controls have the unique capability to combine multiple software "source" files into one executable program. This allows customers to directly use core files on multiple units. On systems that require some site-specific programming, the customer can "code with confidence" (CWC), knowing that critical turbine application logic was not affected.

Some models allow the customer to create a completely independent application program using Multiprog, an IEC61131-3 compliant programming tool.

The GTC250 control's programming tools are optimized for controlling gas turbines and their driven loads. Rather than providing a generic environment that is adaptable to any industrial automation requirement, the software is specific for prime mover and load control. The libraries of supported functions have been proven over many years and countless applications.

Woodward's worldwide organization has unequaled turbine control expertise. To support its OEM and Packager customers, Woodward can supply software tools, or entire solutions, or a variety of options in-between.
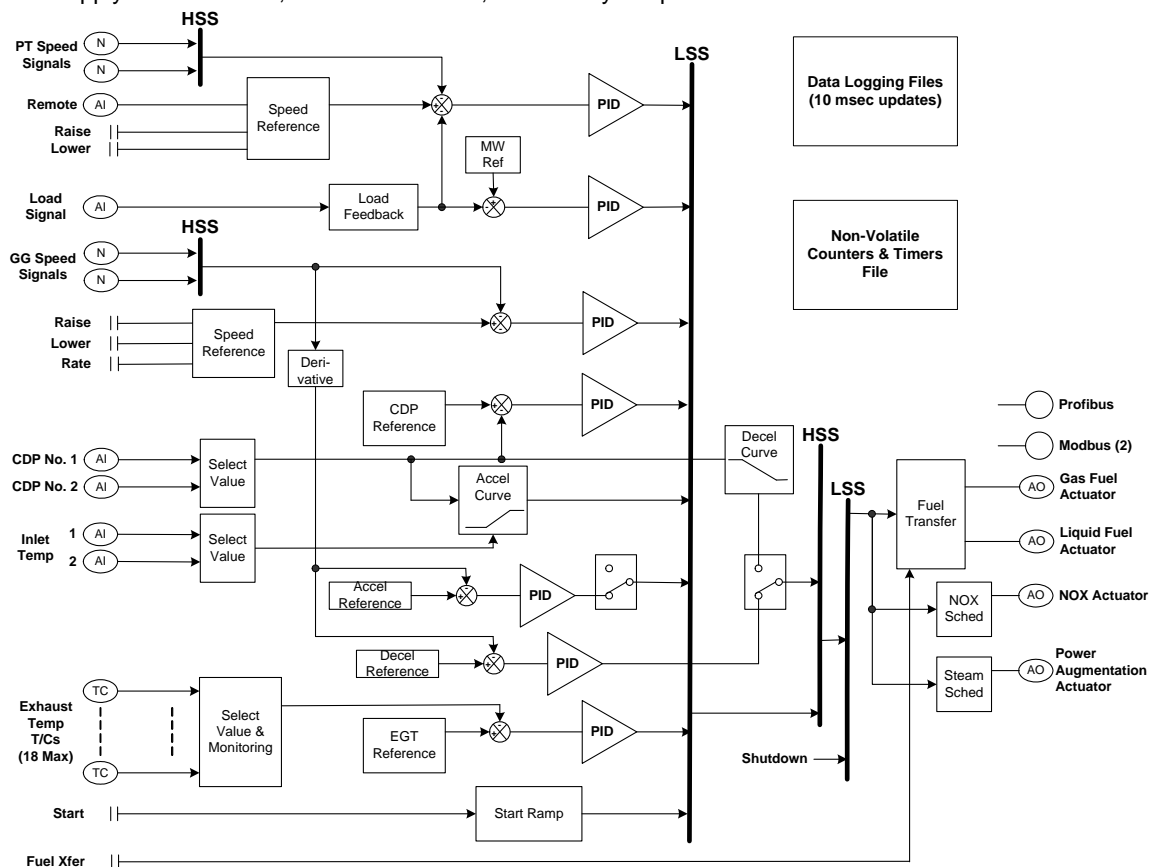
GTC250 Functional Diagram

Real Time Operating System (RTOS)

The GTC250 control system utilizes a popular and field-proven real time operating system (RTOS). The RTOS uses VxWorks®* real time software that has been used in several critical applications for a number of years.

The Rate Group structure of the development environment, integrated with the RTOS, enforces fast, deterministic, and completely repeatable dynamic behavior. Thorough and extensive FFT testing has proven the control system response is exactly as expected at all times, regardless of what is happening elsewhere in the system. The response is also identical to previous proprietary Woodward RTOS architectures. PLCs often make use of a less rigid looping structure that can introduce dynamic instability as code is added or removed.

The RTOS system ensures the highest reliability. All required drivers have been extensively tested for robustness and inability to adversely affect system reliability or real-time control. To ensure integrity, no unapproved drivers can be added.

*—VxWorks is a trademark of Wind River Systems, Inc.

Control and Plant Level Communications

The GTC250 platform supports multiple protocols and physical mediums for communications to DCS systems, PLCs, HMIs, and SCADA systems.

Protocols Supported:
- Modbus (RTU and ASCII) over serial or Ethernet
- Ethernet TCP/IP
- Ethernet UDP
- OPC (Ethernet)—OLE for Process Control
- DDE Dynamic Data Exchange (serial)

Field Bus Interface

Field bus technologies provide the ultimate flexibility in control I/O and distributed intelligence. The GTC250 platform embraces this trend while still providing on-board I/O for those signals that are not commercially or technically ready for field bus distribution.
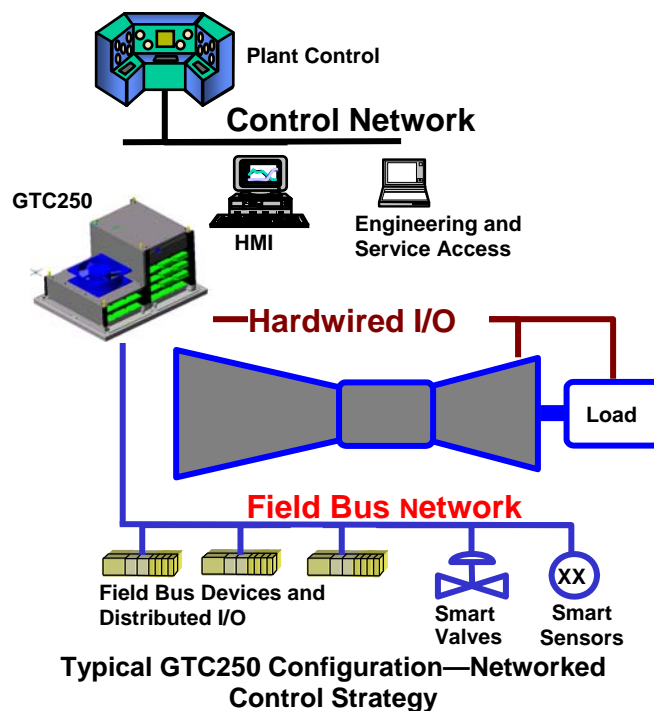
Field bus standards supported:
- Profibus DP (12MBaud)—communications module
- High Speed (115 kBaud) Serial Modbus—standard on Pentium CPU

Typical GTC250 Configuration—Networked Control Strategy

Engineering and Service Access

Woodward offers a complete suite of software products for service interface. From simple monitoring of any system variable to high resolution plotting of control variables, service tools are available to simplify troubleshooting.
- Watch Window—Ethernet or Serial connection to Windows-based control variable viewing (see product spec 03202)
- Control Assistant—Ethernet connection to Windows-based viewing of high-speed data log captures and other useful utilities (see product spec 03201); version 3.2 has internal WinPanel, trending, tunable maintenance
- Application Manager and Other Engineering Interface Tools—Ethernet access to the control for program loading, network configuration and support, and system diagnostics (refer to manual)
- Remote Access—Powerful and seamless remote connectivity is inherent in the operating system of the control system. Remote viewing, access and diagnostics are as close as a network or a modem.
- Human Machine Interface (HMI)—Standard commercial HMI programs interface through Ethernet or serial to provide operator access.

GTC250 Control System Modules

- **Pentium CPU Module**
  - 266 MHz Pentium, 64MB RAM
  - On-board solid state hard drive
  - Hard Real Time VxWorks operating system
  - Ethernet (communications, distributed I/O)
  - *10/100 Base T auto sensing and auto switching*
  - 2 Non-isolated Serial Ports (Service Interface and Remote Access Services)

- **Analog Input/Output Module (qty 3)**
  - 2 MPU speed pickups
  - 4 RTD (100 or 200 ohm, 3 wire) /4–20 mA inputs (software selectable)
  - 6 Thermocouple (E, J, K, N, R, S, T) inputs
  - 5, 4–20 mA inputs
  - 2, 4–20 mA analog outputs
  - On-board cold junction sensor

- **Primary Power Supply**
  - 18–32 Vdc
  - 12 Relay Drivers

- **Profibus Communications Module (optional)**
  - 12 MBaud Profibus DP Master/Slave

- **SmartCore Module**
  - 3 Isolated Serial Ports
    - *1 RS232*
    - *2 configurable RS232, RS422, or RS485*
  - 2 MPU/Proximity
  - 24 Discrete Inputs
  - 6 Analog Inputs (4–20 mA, 0–5 V)
  - 6 Analog Outputs (4–20 mA)
  - 2 Actuator Outputs (4–20 mA, 20–200 mA)

Environmental Specifications

- Skid Mount Packaging
- CE Compliant—Low Voltage Directive, EMC Directive, ATEX Directive
- European Class I, Zone 2, Group IIC when installed in an IP-54 minimum rated enclosure per DEMKO certification
- UL Class I, Div 2, Groups A, B, C, D
- Operating temperature: –20 to +70 °C (+60 °C w/ Profibus, DeviceNet or Dual Ethernet)
- Storage temperature: –40 to +85 °C
- Vibration: Lloyds RS ENV 2 (0.7 g, 15–150 Hz)
- Shock: US MIL-STD-810C, 516.2-2 (30 g, 11 ms, 1/2 sine)
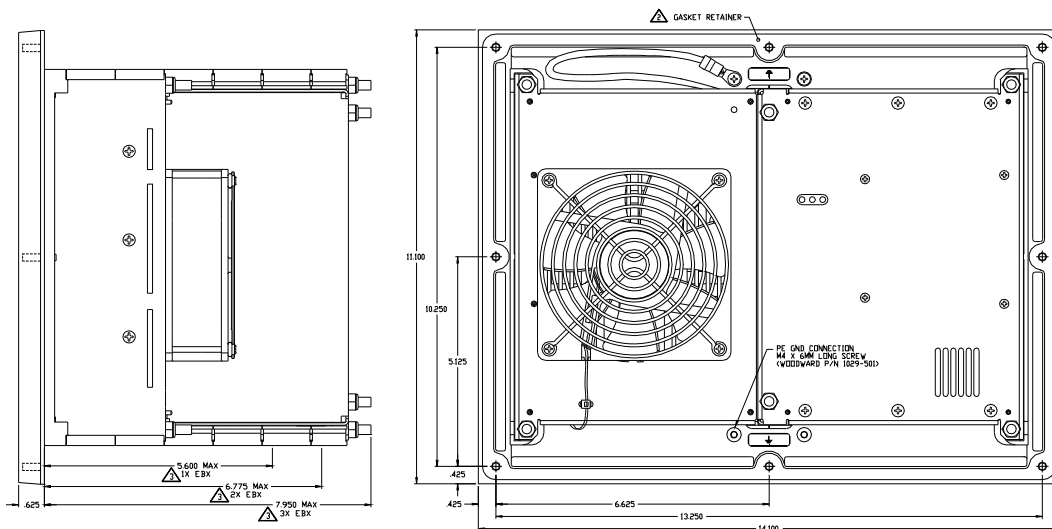
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GTC250 Control Outline Drawing
(Do not use for construction)

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