GTC100 and GTC200

Gas Turbine Controllers

Applications

The GTC100/200 controllers are a field configurable units that can be applied to most industrial gas turbine applications. Typical applications can include:

- Power Generation—Base Loading, Peaking, Stand-by, Marine
- Compression—Gas Processing, Gas Production, Pipeline
- Combined Heat & Power (CHP)

Basic turbine control functions include:

- Gas Generator Speed Control
- Power Turbine Speed Control (GTC200 only)
- MW Limiting
- Exhaust Gas Temperature Control
- Acceleration Limiting
- Deceleration Limiting
- Start Fuel Ramp
- Dual Fuel Transfers
- Light-Off Detection
- Droop/Isochronous Generator Control

Description

The GTC100 and GTC200 industrial controllers offer robust, low-cost control for a wide variety of dual-fuel gas turbine applications. The GTC100 controls single-shaft turbines, and the GTC200 controls two-shaft machines. Industrial microprocessor technology is coupled 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 expansion I/O is used for other less sensitive parameters.

The modular hardware lends itself to bulkhead mounting. Environmental specifications allow the GTC100/200 controllers to move out of the control room and closer to the prime mover. In many cases it can be mounted directly on the skid. Typically, the GTC100/200 controllers are located in an enclosure that is rated for the site-specific environment requirements.

Internally, the control is structured with appropriate computational, I/O, and power supply modules that are stacked to eliminate the need for a motherboard. Hardware cost is significantly reduced. Wiring terminations are provided on the top and bottom edges of the modules by means of quick disconnect plug and socket connectors that are rated for industrial service. Control power is supplied from an external 24 Vdc source.

The GTC100/200 controllers contain required I/O and core fuel control software to control a one- or two-shaft, dual-fuel industrial gas turbine. The I/O and software are configurable to accommodate the specific needs of most applications. In addition to the primary fuel control algorithms, package sequencing and protective monitoring are easily accomplished using spare onboard I/O or external distributed I/O.

The GTC100/200 controllers have a total of three serial ports. One port is dedicated to service of the controller. This interface allows the user to connect a PC/laptop that is running a Woodward service tool program (see Engineering and Service Access). System variables can be viewed, configured, and tuned to meet the needs of the specific application. The two remaining ports are general purpose and utilize Modbus® * protocols. They can be configured to communicate with a variety of external devices and systems (HMI, plant DCS, etc.).

*—Modbus is a trademark of Schneider Automation Inc.
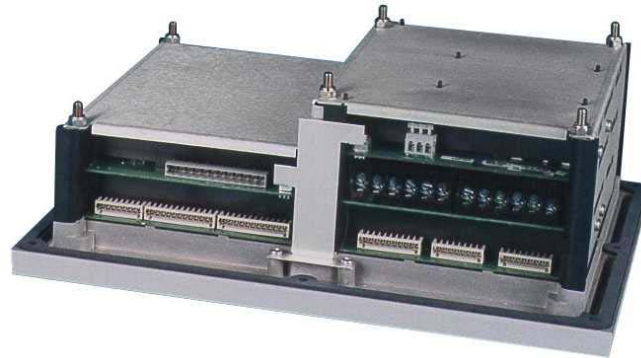
- Woodward proven gas turbine algorithms
- Powerful real time microprocessor control for gas turbines
- Low cost, sensible alternative to a general purpose PLC
- Produced and backed by Woodward—gas turbine control experts
- Real time multi-tasking operating system with deterministic update rates
- Fast, accurate on-board I/O
- Modbus® for additional I/O expansion
- Scalable from speed and turbine control to total package control
- CE Compliant, suitable for hazardous locations (see Environmental Specifications)
- Generator protection (GTC100 *only*)

GTC100 Configuration

The GTC100 controller's Power Sense module allows this controller to configured to include the following functionality (not currently available with the GTC200):

Generator Synchronization:
- Phase Match
- Slip Frequency
- Synch-Check (for manual synchronizing)

Generator Load Monitoring/Control:
- Real/Reactive Load Sensing & Control
- Real/Reactive Load Sharing
- Real Load Limiting
- Isochronous Frequency Control

Generator Protection/Alarming:
- Over/Under Voltage
- Over/Under Frequency
- Over/Under Current
- Over/Reverse Power
- Over/Reverse VAR
- Current Imbalance
- Negative Phase Sequence Voltage
- Negative Phase Sequence Current

Stack Configuration
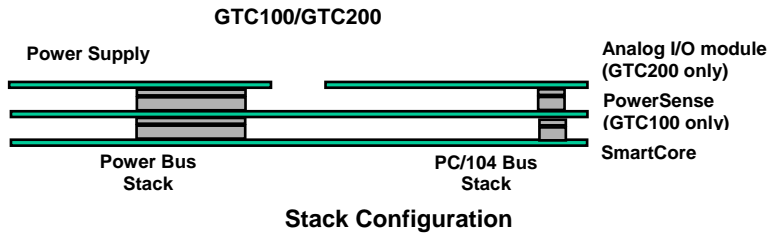
High Performance On-board I/O

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

Real Time Operating System (RTOS)

The Rate Group structure of the GAP development environment enforces fast, deterministic, and completely repeatable dynamic behavior. Thorough and extensive FFT testing has proven that 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.

Modbus Interface

Modbus technology provides excellent flexibility in control I/O and distributed intelligence. The GTC100/200 platform embraces this trend while still providing on-board I/O for those signals that are not commercially or technically ready for I/O distribution.

GTC100 Functional Diagram
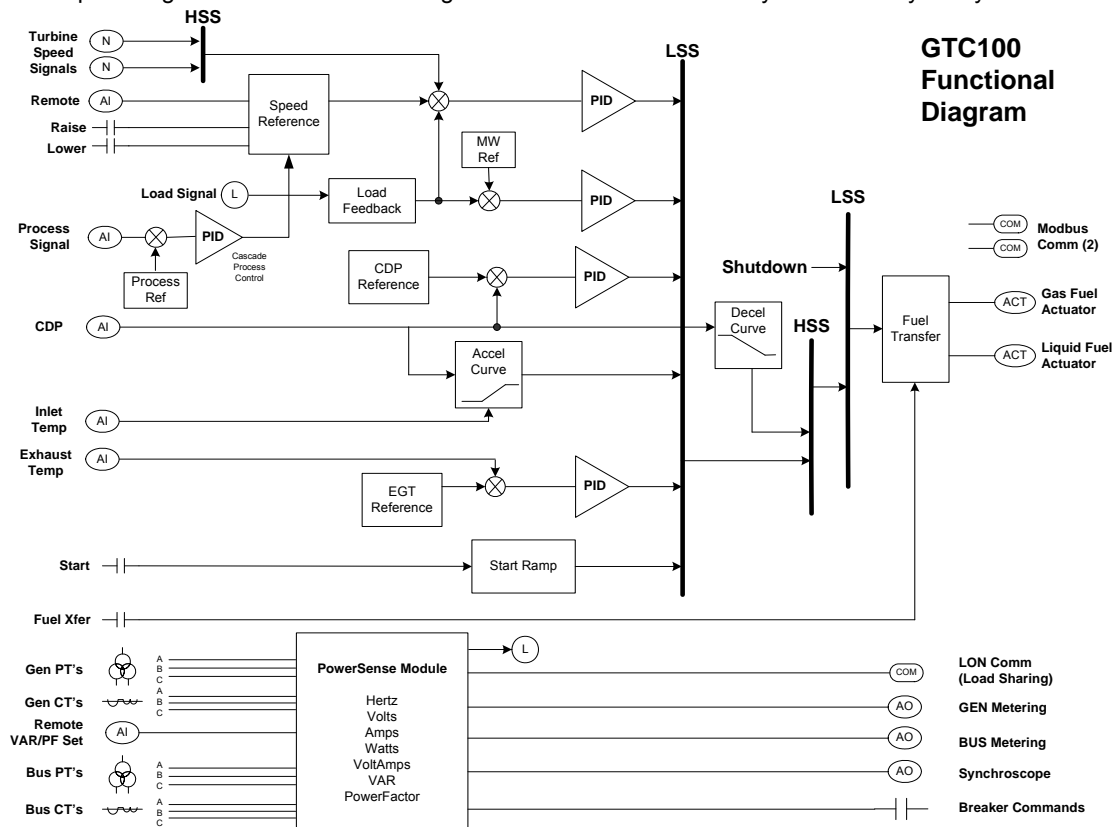
Control and Plant Level Communications

The GTC100/200 platform supports multiple protocols and physical mediums for communications to DCS systems, PLCs, HMIs, and SCADA systems.

Protocols Supported:
- Modbus RTU over serial links
- DDE Dynamic Data Exchange (Serial)

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**—Serial connection to Windows-based control variable viewing (see product spec 03202)
- **Control Assistant**—Windows-based viewing of high-speed data log captures and other useful utilities (see product spec 03201)
- **Human Machine Interface (HMI)**—Standard commercial HMI programs interface provide operator access.

Environmental Specifications

- Skid Mount Packaging
- CE compliant—Low Voltage Directive, EMC Directive, ATEX Directive
- European Zone 2, Group IIC (when installed in an IP-54 minimum rated enclosure per DEMKO certification)
- UL Class I, Division 2, Groups A, B, C, D
- Operating temperature: –20 to +70 °C
- Storage temperature: –40 to +85 °C
- Vibration: SAE J1455 (8.2 Grms 10-2000 Hz)
- Shock: US MIL-STD-810C, 516.2-2 (30 g, 11 ms, 1/2 sine)
- Marine Type Approvals (ABS, DNV, LRS)
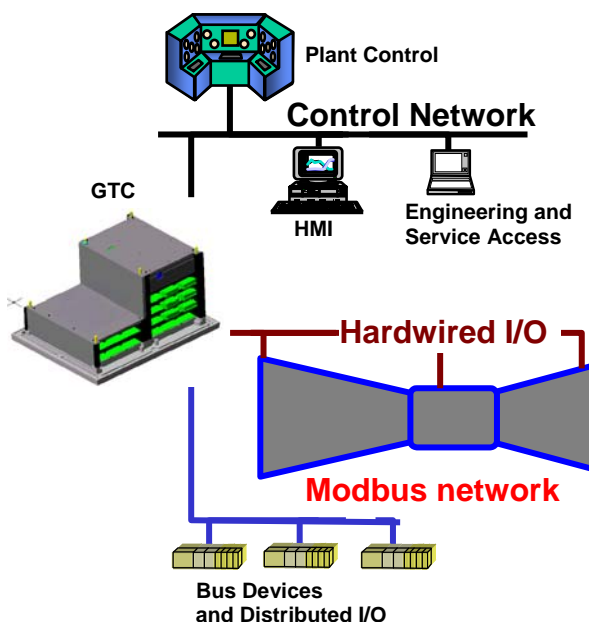
Typical GTC100/200 Configuration—
Networked Control Strategy

GTC200
Functional
Diagram
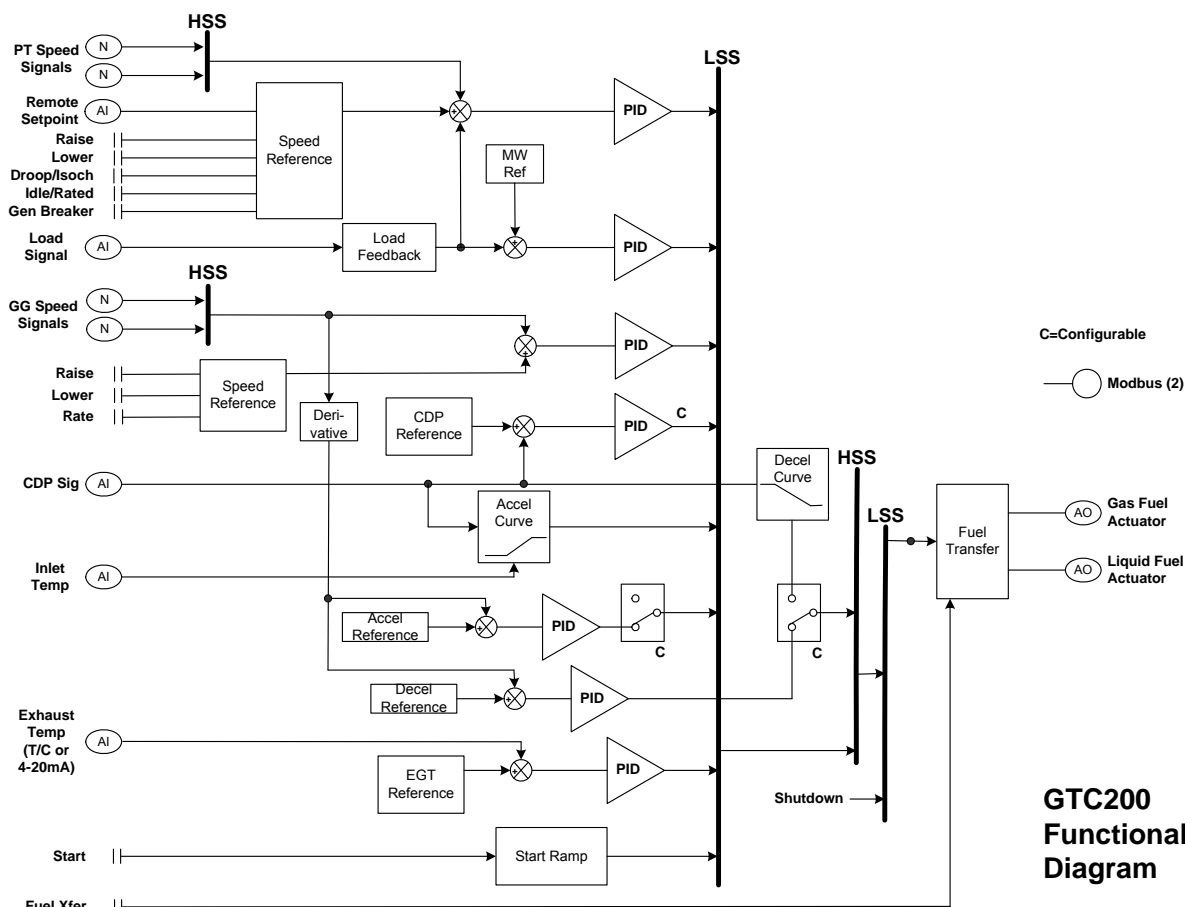
GTC100/200 Control System Modules

- **SmartCore Board**
  - 3 Isolated Serial Ports
    - *1 RS-232 (service port)*
    - *2 configurable RS-232, RS-422, or RS-485*
  - 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, 20–160 mA)

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

- **Atlas I/O Board (optional)**
  - 2 MPU speed pickups
  - 4 RTD (100 or 200 Ω, 3 wire) /4–20 mA inputs (software selectable)
  - 11 Thermocouple (E, J, K, N, R, S, T) / 4–20 mA inputs (software selectable)
  - 2 4–20 mA analog outputs
  - On-board cold junction sensor

- **PowerSense Board (optional)**
  - 70/120/240 Vac PT sensing
  - 2 three-phase voltage inputs
  - 2 three-phase current inputs
  - 0–5 A CT sensing
  - Speed Bias (PWM, 4–20 mA, 0–5 V, ±3 V)
  - Voltage Bias (4–20 mA, ±1 V, ±3 V, ±9 V)
  - LON Channel – communicate to other Woodward Power Management Controls
  - Revenue grade accuracy (ANSI C12.1)
  - Power calculated per IEEE 1459
  - Harmonic metering to 13th harmonic for both voltage and current

Control Outline Drawing
(Do not use for construction)
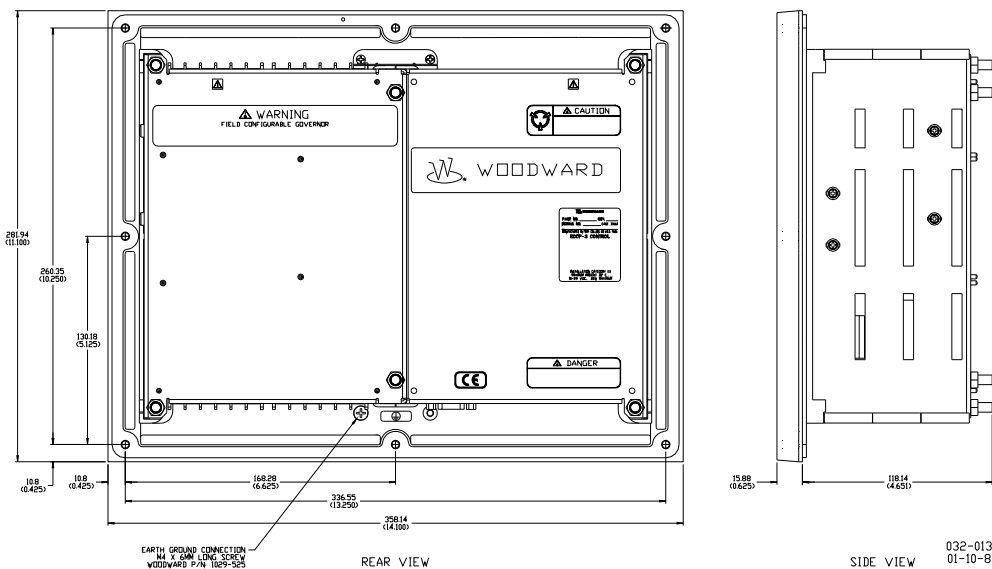
Technical Manual   26284 (GTC100), 26262 (GTC200)

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