

GTC250A-FC

Aero-Derivative Gas Turbine Fuel Control

Applications

The GTC250A-FC is specifically designed to control aero-derivative-type dual-shaft gas turbines. It includes field proven OEM-conforming fuel control algorithms for single- or dual-fuel turbines used in generator drive or mechanical drive applications. Typical applications include:

- Generation—base loading, peaking, stand-by, and marine
- Compression—gas processing, gas production, and pipeline pumping
- Combined heat and power (CHP)
- Combined cycle power generation
- Mechanical and marine propulsion drives

Speed, load, and temperature algorithms maintain precise fuel control within the turbine's operating limits over the entire range of turbine operation, as well as during unforeseen operational disturbances, to provide safe, reliable gas turbine system control. The controller's special PID-to-PID transfer logic allows stable control during normal operations and bumpless control mode transfers during plant upsets, minimizing process over- or undershoot conditions. The unit's environmental specifications allow it to be mounted close to the turbine package for increased critical control-signal reliability.

The GTC250A-FC is designed to be a Fuel Control (FC) only, and can interface directly to the gas turbine's sequencing logic performed elsewhere.

Field-configurable and ideal for retrofits, the GTC250A-FC provides users with a low-risk fuel control that allows them to benefit from its well tested gas turbine algorithms and hardware.

Description

The GTC250A-FC is built on Woodward's industrial-hardened Atlas-II™ platform, and include a standard, field-configurable, core fuel control system that controls turbine speed, load, start ramp, temperature, fuel valve position, and fuel transfers for dual-fuel applications.

The GTC250A-FC contains standard core engine control functions, which are protected, but can be configured with site-specific values using the included graphical configuration software service tool. This control is designed to provide the confidence of a field-proven core fuel control that interfaces directly to site-specific functions contained in PLC or DCS systems through hardwired connections or Modbus®* ports.

Woodward's service interface software allows the user to view and tune system variables. Data logging files are included to facilitate troubleshooting, and non-volatile counter/timer files keep track of starts, fired hours, and other useful data.

The hardware lends itself to bulkhead mounting. Environmental specifications allow the GTC250A-FC to move out of the control room and closer to the prime mover. In many cases, they can be mounted on the prime mover skid. Typically, they are mounted in an enclosure rated for the site-specific environmental conditions. A variety of computational and I/O signals are 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.



- Field-proven fuel control algorithms
- Integral configuration tool
- Low cost—sensible alternative to a general purpose PLC
- Deterministic update rates as fast as 5 ms
- Multiple communications protocols:
 - ✓ Modbus®
 - ✓ Ethernet TCP/IP
 - ✓ Ethernet UDP
 - ✓ OPC (Ethernet)
 - ✓ DDE (Dynamic Data Exchange)
 - ✓ CANopen
- High speed data logging and trending troubleshooting tools
- Non-volatile counters & timers file
- CE and UL Compliant; Marine Type Approved
- SNTP Compliant for time synchronization

*—Modbus is a trademark of Schneider Automation Inc.

Functionality

Core Fuel Control

- Start fuel ramp
- Dual-shaft speed sensing (w/ redundant probes)
- Gas generator (GG) speed derivative (acceleration & acceleration) control
- Remote PT and GG speed reference logic
- Load control
- Exhaust gas temperature (EGT) monitoring (1–11 T/C inputs)
 - ✓ Use of all T/Cs, including protection T/Cs
 - ✓ Auto rejection with deviation from average spread
 - ✓ Highest and lowest EGT T/C
- EGT limiting control
- Ambient temperature sensing
- Compressor discharge pressure (CDP or PCD) control
- Flame detection logic (temp, discrete in, or analog in)
- MW load limiting control (selectable)
- Single-fuel or dual-fuel operation with fuel transfer logic
- Overspeed detection/protection

Optimized On-board I/O

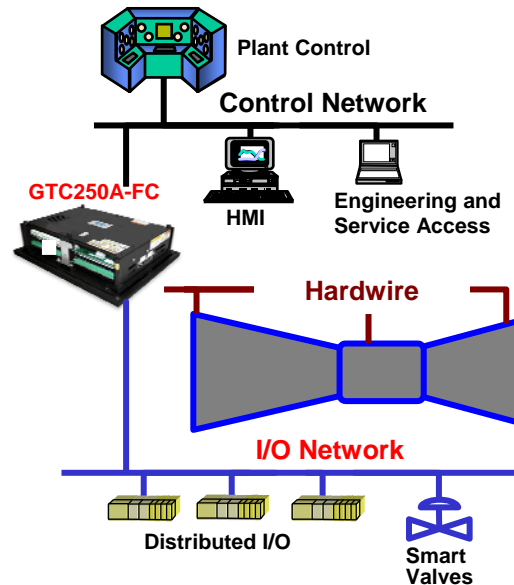
- High-speed and deterministic update times
- High CMRR and control-specific filtering result in high degree of noise immunity
- 15 bit resolution differential inputs, allowing very precise control
- I/O is accurate across temperature range
- I/O is isolated in groups to prevent ground loops and other induced noise issues
- Serial RS-232, RS-422, or RS-485
- Ethernet (10/100 MBaud)
- CANopen

Fuel Valve Interfacing

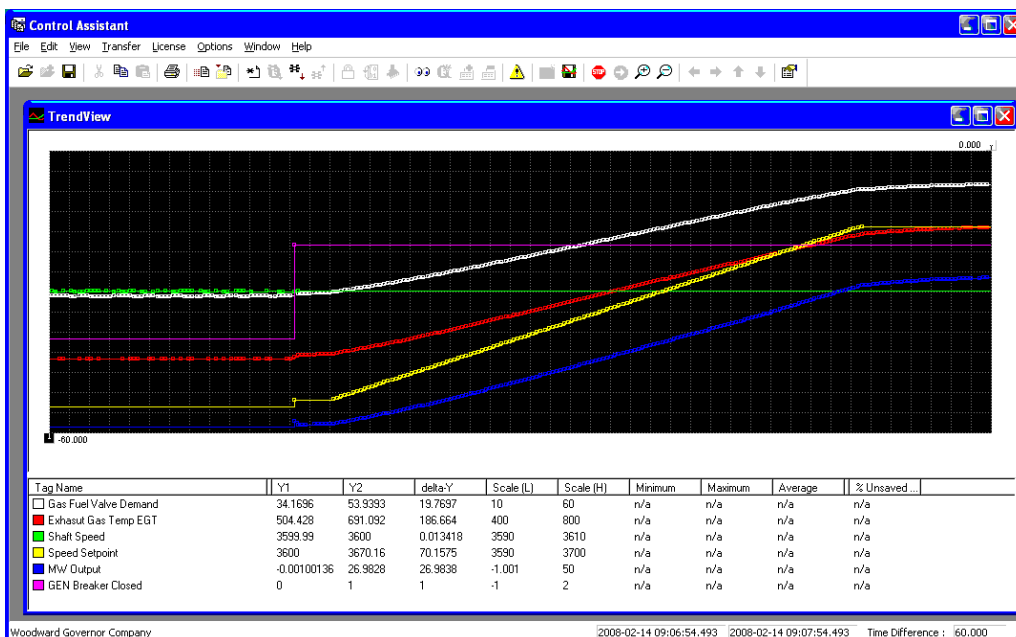
- Direct to Woodward's standard valve offerings using CANopen
- Via Woodward's SPC Servo Position Controller to most existing systems for integrating actuators
- Configurable 4–20 or 0–200 mA proportional drivers (2)

Communications Protocols

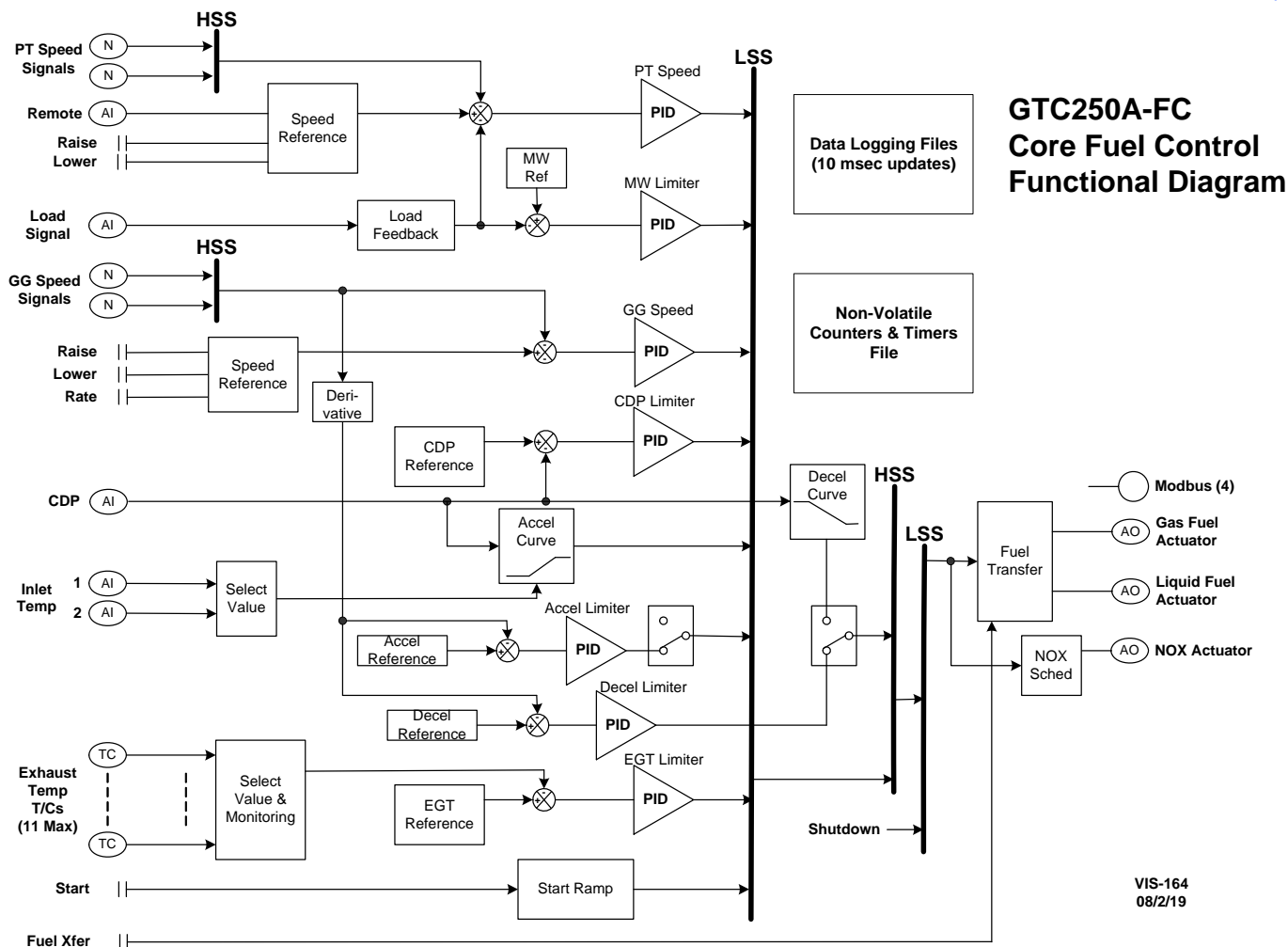
- Modbus (RTU and ASCII) over serial or Ethernet
- Ethernet TCP/IP
- Ethernet UDP/IP
- CANopen
- OPC DA 3.0 and AE 1.0



Typical GTC250A-FC Configuration—Networked Control Strategy



Typical Trend Data Available in the GTC250A-FC



GTC190M_Netsim.vttool - Woodward ToolKit

Page 1 - Turbine Overview

Turbine Parameters

Unit Actual Speed

3600

Speed Reference Setpoint

3780

EGT Average Temp: 988 Deg F

Compressor Discharge Pressure: 156.8 psia

GEN Breaker CLOSED: True

Generator MW Output: 70.0 MW

Unit Status: Unit is in Load Control

Control Regulator

Unit Running

- Fuel ON
- Start Ramp Control
- Speed Control
- MW Control / BaseLoad
- MW Limit Control
- EGT Control
- AUX 1 Control
- AUX 2 Control
- EGT Deriv Control
- Accel Limit Control
- Decel Limit Control

Start Sequence

- Fuel OFF
- Start Sequence OFF
- Initiate Start Seq
- Purge Cycle
- Ignition - Attempt Lite-Off
- FSDV Open / Ignitors ON
- Flame Established / Accel
- Accelerate to Idle Speed
- Warmup at Idle Speed
- Accelerate to Rated Speed
- Unit at Rated Speed
- Normal STOP Seq Active

Operational Commands

Push for ESTOP

START/RUN ON

Push to Lower Speed Setpt

Push to Raise Speed Setpt

Enable Remote Speed Ref

Enable Ext Synchro

Enable MW Control

MW Setpoint: 50

Shutdown FUEL

Start (Diff = Normal Stop)

Lowering Speed Ref (Lower Load)

Raising Speed Ref (Raise Load)

Remote Speed Ref ON

External Synchronizer Enabled

Enable MW Control

Fuel System Status

Gas Fuel Actuator Demand: 95.1 % Gas

Liquid Fuel Actuator Demand: 0 % Liquid

FuelXFER Request Fuel Transfer in Progress

Simulate GEN Breaker Open

Alarm/Shutdown Status

HORN Output

EVENT	EVENT Numbers
<input checked="" type="checkbox"/> ALARM Summary	ALARM 0
<input type="checkbox"/> Open Breaker Trip	Open Breaker Trip 0
<input type="checkbox"/> SHUTDOWN (Fuel OFF)	SHUTDOWN Summary 0

EVENT Annunciation

ALARM Event: CLEAR

Open Breaker Trip: CLEAR

SHUTDOWN Event: CLEAR

ACKN Acknowledge Received

RESET Reset Received

Go to Page 2

GTC250A-FC Operating Interface

Engineering and Service Access

Woodward's software service tools provide service personnel with extensive monitoring and troubleshooting for the GTC250A-FC. The service tools provide operational and analytical information such as graphical display of operating data, data logging (at rate group resolution), trending, event logging, X-Y plotting, and other features.

The following software tools come standard with the GTC250A-FC:

- Graphical Interface Software Configuration Tool—Ethernet access to allow unit configuration, calibration, and setup.
- Application Manager and Other Engineering Interface Tools—Ethernet access to the control for program loading, network configuration and support, and system diagnostics

Other useful software tools (licensing required):

- Control Assistant—Ethernet connection to Windows-based viewing of high-speed data log captures and other useful utilities; including trending, tunable maintenance.

GTC250A-FC Control System Modules

A5200 SmartCore Module

- Powerful Freescale MPC5200 CPU
- 2 configurable RS-232, RS-422, or RS-485
- 4 Ethernet communication ports
- 2 CANopen communication ports
- 2 MPU/proximity
- 24 discrete inputs
- 6 analog inputs (4–20 mA)
- 4 analog outputs (4–20 mA)
- 2 actuator outputs (4–20 mA, 20–200 mA)

Primary Power Supply

- 18–32 Vdc
- 12 relay drivers
- Optional external relay module with 12 Form C relays (5441-699) and interface cable (5417-747)

Analog Input/Output per Module (1 module)

- 2 MPU speed pickups
- 2 RTD (100 or 200 ohm, 3 wire) /4–20 mA inputs (software selectable)
- 11 thermocouple (E, J, K, N, R, S, T)
- 2 analog inputs (4–20 mA)
- 2 analog outputs (4–20 mA)
- On-board cold junction sensor

Regulatory Compliance

North American:

UL: UL Listed for Class I, Division 2, Groups A, B, C, & D, T3C at 70 °C surrounding air temperature. For use in Canada and the United States.
UL File E156028

European Compliance for CE Marking:

EMC Directive: 2004/108/EC
Low Voltage Directive: 2006/95/EC
ATEX Directive: 94/9/EC (Zone 2, Cat. 3, Group II G, Ex nA IIC T3 X)

Marine Compliance

Models are available that are suitable for marine applications.

ABS: ABS Rules 2006 SVR 4-2-1/7.3, 7.5.1, 7.9.3/174-9-7/Table 9
DNV: Standard No. 2.4, 2006: Temp. Class B, Hum. Class B, Vib. Class C, and EMC Class A
LRS: Test Specification No. 1, 2002: ENV1, ENV2, and ENV3

Environmental Specifications

Skid Mount Packaging

- Operating temperature: –20 to +70 °C (+60 °C w/ Profibus in GTC250A-TC)
- Storage temperature: –40 to +85 °C
- Vibration: Lloyds Test Specification No. 1, 2002, Vibration Test 1 (5–13.2 Hz, ±1 mm; 13.2–100 Hz, ±0.7 g)
- Shock: US MIL-STD-810C, 516.2-2 (30 g, 11 ms, 1/2 sine)
- Marine Type Approvals: ABS, DNV, LRS



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