

Gas Turbine Control System Products and Technologies Overview

Application Sheet 51228A



Custom Digital Controls (Programmable)



MicroNet™ Plus

The MicroNet™ Plus Controller is a state-of-the-art, programmable, digital controller. It can be programmed to control any prime mover and its associated processes, as well as system sequencing, high speed system monitoring, surge control, vibration monitoring and station control. The MicroNet™ Plus digital control is available in simplex, dual-redundant, and triple modular redundant (MicroNet™ TMR) configurations.

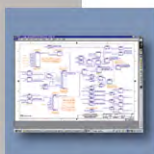
(product specs 03333 & 85583)



Atlas II™

The Atlas II™ control is an industrial platform that offers robust, low-cost control for a wide variety of turbine, engine, and compressor applications. With a proven real-time operating system and dedicated inputs and outputs, the Atlas II provides reliable and deterministic performance for key prime mover control functionality.

(product spec 03213)



The many decades of Woodward experience with controlling engines and turbines, has been translated into a sophisticated suite of software tools specially tailored to prime mover applications.

- GAP™ — Graphical Application Programmer is an IEC 61131-3 graphical programming environment with function blocks that are specialized for turbine and engine control applications.
(product spec 03216)
- Real Time Operating System (RTOS) — Provides the software architecture to meet the real-time requirements of the most complex turbine control problems.
- NetSim™ — Simulation software that executes a GAP application program and allows program inputs to be changed to simulate the open-loop operation of the control. GAP can be compiled directly for PC Simulation with NetSim against engine models in ACSL, MATRIXx, Simulink, or Matlab.
(product specs 03292 & 03293)
- Service Tools — A range of options from on control displays for local control and service, debug, and configuration functions, to PC based windows software programs for advanced troubleshooting and maintenance.



HMI (Human Machine Interface)

HMI (Human Machine Interface) for Woodward electronic controls is primarily Windows based PC software. Utilizing proven Intellution® 32-bit software that is compatible with both Windows 95, 2000, and XP operating systems, customers can do on-line configuration, trending, reporting, statistical process control, alarming and alarm management, remote monitoring, and supervisory control and data acquisition. This intuitive interface features on-line help and offers true plug and play hardware compatibility.

SA (Standard Application) Configuration Digital Controls



GTC250

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.

(product spec 03303)



GTC190

The PC-based GTC190 control system is an ideal solution for controlling a single-shaft large industrial gas turbine. Typical large industrial gas turbine control loops (speed, load, EGT, etc.) come standard within the core system, while distributed I/O can be used for other less critical parameters. Both single and dual fuel capabilities are available with the GTC190.

(product spec 03294)



GTC100 and GTC200

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 micro-processor 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.

(product spec 03319)



2301D-GT

The 2301D-GT Digital Load Sharing and Speed Control is a microprocessor-based control with integral application software designed for single-shaft gas turbine applications driving either mechanical or generator loads. The control is housed in a sheet-metal chassis and consists of a single printed circuit board. To facilitate unit retrofits, the 2301D-GT's I/O terminals are located in the same general location as Woodward's 2301A line of controls. This control is designed to perform the core fuel control functions of a small gas turbine package. The application software is field configurable, allowing it to be configured and modified to meet site-specific requirements.

(product spec 03236)

Gas Fuel Metering



SonicFlo™ Valve

The SonicFlo™ valve controls the flow of gas fuel to the combustion system of an industrial or utility gas turbine from 15–300 MW in size. The SonicFlo valve is available as a hydraulically-actuated 2", 3", 4", or 6" valve size with maximum gas pressure of 1724 to 3965 kPa (250 to 575 psig). Large electric SonicFlo valves are also available in 2" or 3" valve size with maximum gas pressure of 2070 to 3450 kPa (300 to 500 psig). The unique design yields a linear flow characteristic unaffected by discharge pressure up to a pressure ratio (P_2/P_1) of 0.8. The design also integrates the valve and actuator into a compact assembly. The key characteristics of this valve are a highly linear critical gas flow versus stroke relationship at constant upstream pressure. The integral actuator is a single-acting spring-loaded design for failsafe operation. The actuator includes an onboard hydraulic filter for last chance filtration of the fluid to ensure reliability of the servo-valve and dual rod LVDT (linear variable differential transformer) directly coupled to the hydraulic piston.

(product spec 03285)



Gas Stop / Ratio Valve

The Woodward Gas Stop/Ratio Valve performs a dual function for industrial or utility gas turbines. One function rapidly shuts off fuel to the turbine fuel control system. Another function provides accurate control of gas fuel pressure at the outlet of the stop/ratio valve. This pressure is applied to the inlets of the gas fuel control valve. The Gas Stop/Ratio Valve comes in 2", 4", 6", and 8" valve sizes and features a modular design, and meets critical control characteristics while allowing the same valve design to accommodate a variety of stroke, force output, and mechanical interface arrangements. The electrical and mechanical interfaces have been designed for quick and easy assembly or removal of the valve, at the factory or in the field. The components include an on-board hydraulic filter, electrohydraulic servo valve, trip valve, single-acting hydraulic cylinder, and dual LVDTs.

(product spec 26093, 26230)



Hydraulic Globe Valve

The Hydraulic Globe Valves (HGV) control the flow rate of natural gas fuel to various stages of an industrial gas turbine combustion system. The unique design integrates the valve and actuator into a cost-effective, compact assembly. The valve is designed to provide a highly accurate flow-versus-stroke characteristic. The integral actuator is a single-acting springloaded design that will quickly close the valve upon loss of electrical or hydraulic signals. This valve comes in 2", 3", and 4" sizes with maximum gas pressure of 3792 kPa (550 psig). The servovalve is an electrically redundant dual-coil design. A dc-powered LVDT (DCDT) provides feedback for the actuator.

(product spec 03314)



Electric Gas Metering Valve

Electric Gas Metering Valves (EGMV) control the flow of gas fuel to the combustion system of an industrial or utility gas turbine. This product is a globe-style plug valve that provides linear flow area characteristics as a function of valve opening. The electric actuator contains a failsafe spring designed to close in less than 250 ms. This product comes in 2" and 3" valve sizes with maximum gas pressures of 6895 kPa (1000 psig) up to 38C and 6209 kPa (900 psig) up to 204C.

(manual 26305)



3103 Gas Valve

The 3103 gas valve is a stainless steel valve capable of metering gas flow between 23 and 18 144 kg/h (50 and 40 000 lb/h). It is designed to be corrosion resistant and self-cleaning, allowing it to operate in sour gas environments (high sulfur content gas) that can cause problems for other valves. This valve is available with either electric or hydraulic actuation. When used in conjunction with an EM35MR electric actuator and EM 24 V digital driver, the 3103 valve delivers the demanding accuracy needed for DLE applications.

(product spec 03209, 40106, 40156)



GS Series

Woodward GS series gas fuel metering systems are designed for use on industrial gas turbines in the 200 KW to 30 MW output power range. The assemblies provide reliable, cost effective interfaces between electronic engine control systems and gas turbines used in power generation, compressor, and mechanical drive applications.

(GS 6 product spec 03256)

(GS 16 product spec 03284)



GSOV25HT

The GSOV25HT Gas Shutoff Valve is designed to provide extremely fast shutoff to gaseous flow and to be used for emergency and normal shutdown operation. The valve operates at pressures up to 900 psia and its all stainless steel construction assures availability of the valve under all operating conditions. The valve design allows minimum pressure drop by utilizing a straight through flow, this also keeps all critical moving parts and seals out of the flow stream.

(product spec 03286, 40128, 40176)



Dry Low Emission Combustion

Woodward is a leader in fuel metering for Dry Low Emissions Combustion Control. For applications requiring from 2 up to 5 parallel paths Woodward can provide the fuel metering system and the control. Our DLE fuel metering systems are capable of 2.0% of point, mass flow accuracy and our current programs cover multiple small industrial engines and aero-derivatives.

Liquid Metering



Fuel Oil Bypass Control Valve

The Three-way Fuel Oil Bypass Control Valve is used to control the flow of liquid fuel to a gas turbine. This valve contains 3" ports and has a maximum fluid supply pressure of 8274 kPa (1200 psig). The valve contains no feedback device, so it relies on external flow measurement as a form of feedback to control the flow. Upon loss of electrical command signal or hydraulic pressure, the valve will divert fuel to the bypass port for a safe turbine shutdown. The valve utilizes a fully integrated valve and actuator design. The design is equivalent to a dual acting electrohydraulic actuator and a three-way bypassing valve.

(manuals 26088, 26226)



Fuel Oil Stop Valve

The Three-way Fuel Oil Stop Valve is a two position valve used to shut off the flow of liquid fuel to the turbine and divert it to the fuel pump suction. This valve contains 3" ports and has a maximum fluid supply pressure of 8274 kPa (1200 psig). The valve position is controlled by a low level trip pressure acting on the pilot operated trip circuit integrated into the valve. The valve uses a failsafe spring to ensure the shutoff of fuel from the turbine on loss of hydraulic control pressure or hydraulic actuation pressure. The valve utilizes a fully integrated valve and actuator design. This design is equivalent to a single acting hydraulic actuator and a three-way shut-off valve.

(manuals 26088, 26226)



LSOV25

The LSOV25 Liquid Shutoff Valve is an electric three-way valve designed to rapidly shut off all liquid fuel flow and prevent leakage to the turbine. In the de-energized state, the valve diverts inlet flow to bypass ports, preventing pressure damage to positive displacement fluid systems. Normal installation of the 45 lb (20 kg) valve is in the fuel line between the fuel regulating valve and the turbine. The valve diverts flows from the discharge to bypass ports any time the operating electrical signal is lost. The valve is available in two voltage configurations. The valve is designed for a normal operating supply pressure of up to 1200 psig (8274 kPa) and has a rated flow of 30 000 lb/h (13608 kg/h) based on Mil-C-7024 calibrating fluid at 70 °F (21 °C).

(product spec 40169)



LQ Series

Woodward's LQ series of liquid fuel metering valves are designed for use on industrial and aero-derivative gas turbine engines in the 1000 kW to 42 000 kW output power range. LQ series valves are designed for flows from 80–4000 lb/h (36–1814 kg/h) for the LQ3, 80–10 800 lb/h (36–4900 kg/h) for the LQ6, and 80–26 000 lb/h (36–11 794 kg/h) for LQ25 valves with 0.82 specific gravity liquid fuels. The assemblies provide reliable, cost-effective interfaces between electronic engine control systems and gas turbines used in power generation, mechanical drive, and marine applications. The LQ valves utilize corrosion resistant, shear type metering components that are positioned by high torque electric actuators to assure extended operation in all types of liquid fuel service.

(LQ series product spec 40174)

(LQ6 with on-board driver product spec 03288)

(LQ25T product spec 40179)



3151A / EML 100 Water Valve

The 3151A /EML100 Water Valve Actuator assembly is used as part of a gas-turbine nitrous oxide emission-reduction system, and can flow up to 78 US gal/min (295 L/min). The unit meters water injected into an industrial gas turbine's combustion chamber, lowering combustion temperature. This assembly is designed to be used with the Woodward EM Digital Driver.

(product spec 40187)

Fuel Nozzles



Woodward offers one of the widest ranges of technology options available for fuel spray components, including gas injection, liquid injection, dual fuel, and dry low emissions. These product lines incorporate an unmatched combination of products, technologies and application expertise:

- Pressure Atomizing Nozzles
- Airblast and Air Assist Nozzles
- Hybrid Airblast Nozzles
- Industrial Nozzles (standard and DLE)
- Augmentor Spray Manifolds
- Augmentor Spraybars
- Fuel Metering and Distribution Valves

On Engine Accessories



Woodward provides a variety of actuators, pumps, servo valves, and hydraulic control units to deal with variable geometry needs on the engine. Typical applications control variable stator vanes, inlet guide vanes, variable bleed valves, thrust balance, etc.

Power Management



easYgen-3000

The easYgen-3000 is a control unit for engine-generator system management applications. The numerous inputs and outputs, along with a modular software structure, allow you to use the easYgen-3000 for a wide range of applications with only a single part number. This includes stand-by, AMF, peak shaving, import/export or distributed generation, among others. Also the easYgen-3000 is compatible for island, island parallel, mains parallel and multiple unit mains parallel operations.

(product spec 37258)



SPM-D

Digital synchronizers from Woodward span the full range of synchronizer capabilities, providing precise voltage and phase matching capabilities for every application, from the simplest to the most demanding.

(SPM-D 10 product spec 37297)

(SPM-D 10YB product spec 37298)

(SPM-D 11 product spec 37292)

(SPM-D 21 product spec 37293)



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(SPM-D 11 product spec 37292)

(SPM-D 21 product spec 37293)



UMT 1

The UMT 1 is a digital multi measuring transducer that measures true rms via three-phase measuring of voltage and current. Three analog outputs - 20/0/4-+20 mA and an analog output manager offers the flexibility to output every measured and calculated value. The impulse output can be configured to output kWh/h or kVARh/h.

(product spec 37168)



EGCP-3

Designed for medium- and large-sized generators, the EGCP-3 is a complete turbine generator power management package designed to work with automatic voltage regulators and speed controls, and contains advanced IEEE protection algorithms, revenue-grade metering, individual control of utility and inter-tie breakers, added input/output capabilities and backward compatibility with Woodward DSLC/MSLC synchronizers. A network of up to 16 EGCP-3 controls can handle your most sophisticated base-load, peak shaving or backup power generation applications. Based on Woodward's powerful GAP™ application programming tools, the EGCP-3 can be easily customized.

(EGCP-3 LS Multi-Unit Load Share product spec 03300)

(EGCP-3 MC Multi-Unit Mains Controller product spec 03301)



HighProTec

The latest relay series for a comprehensive protection of power generating and power distributing systems.

When developing the new relays great care was bestowed on high flexibility, achieved by modular relay components, together with easy handling of the device. All relays of the HighProTec line are furnished with a high-contrast graphic display. On-going measuring values, messages alarms and fault data are displayed in clear text. Guiding texts assist the operator when setting parameters. Inadmissible inputs are prevented by plausibility checks.

All current and earth current inputs are designed for 1 A and 5 A. The nominal voltage of the voltage inputs and the switching thresholds of the digital inputs can be adjusted via software. The wide-range power supply units cover all standard aux. voltages, both for DC and AC.

Even standard type of the individual relays stands out for its wide functional range, hence with only one relay type a great number of applications can be covered. All HighProTec relays as well as the related parameter setting software »Smart view« have one thing in common - the really easy operating concept.

This complete relay series covers all protection applications from basic current or voltage protection up to distance protection for high voltage transmission lines. All relays are in compliance with the relevant international standards, as for instance, IEC60255.

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