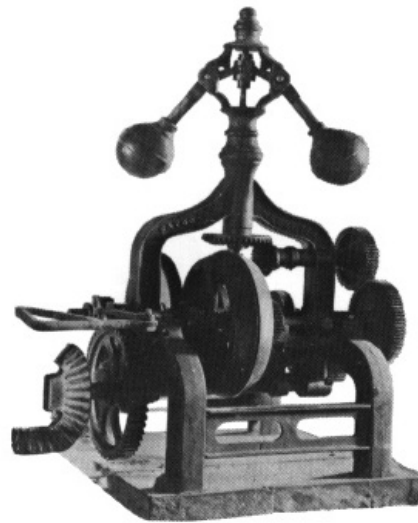




**Reference Manual**



## **Glossary of Control Names for Industrial Applications**

**[from “1000” to “8290”, from “ABLS” to “WO”]**

**Manual 25179D**

## Have we forgotten anything?

Revision D updates nomenclature to March, 2004. This brief glossary lists many, but not all, Woodward controls for industrial applications. If there is a control name not listed that you'd like to know about (or if you notice any errors), please e-mail us at:

**icinfo@woodward.com**

Thanks!

### **New Listings in this revision:**

March, 2004—2000, 2300, 5001LST, 5009LST, 505CC-2, 505DE, APECS™, APM, D-1, DPG, Dyna, easYgen™, EBV, EML, GSOV, GTC, GW, HGV, IKD, IMS, LQ, LS, MI-04, OH1, Power Flow, SLE, *Smart*IFS™, SMP, *STExcite*™, Streamline™, STS100, SwirlFlash, SynconPanel, TUG, UMT

## About Woodward

Founded by Amos Woodward in 1870, Woodward Governor Company initially made controls for waterwheels and then moved to hydro turbines. In the 1920s and '30s, Woodward began designing controls for diesel and other reciprocating engines and for industrial turbines. Also in the 1930s, Woodward developed a governor for variable-pitch aircraft propellers. And when the United States military's first turbine-powered aircraft successfully flew, its engine had a Woodward control. Starting in the 1950s, Woodward began designing electronic controls, first analog and then digital units.

The following names are trademarks of Woodward Governor Company:

APECS™	Harvstmor™	ProTech®
AtlasPC™	HealthChek™	QuadraLink™
AtlasSC™	IGEM®	Red Team™
AutoBalancer™	In-Pulse™	Smart™
CLC™	LinkNet®	<i>Smart</i> IFS™
DSLCTM	MicroNet™	SmartPanel™
easYgen™	MOE™	SmartTrend®
ElectroCam™	mTech™	SOGAV™
Excel®	NetCon®	SonicFlo™
FC™	NetSim™	ST-125™
FireFly™	OpFamily®	<i>STExcite</i> ™
Flo-Tech™	OpPanel®	Streamline™
GAP™	OpTrend®	Swift™
GatePro™	OpView™	TecJet™
GECO™	Peak®	TQ-125™
GenDec™	ProAct™	TrackTion Master™
Glo-Tech™		

Woodward Governor Company reserves the right to update any portion of this publication at any time. Information provided by Woodward Governor Company is believed to be correct and reliable. However, no responsibility is assumed by Woodward Governor Company unless otherwise expressly undertaken.

© Woodward 1992  
All Rights Reserved

---

# Glossary of Control Names

---

## Woodward Industrial Applications

This glossary covers controls intended for industrial (non-aircraft) applications.

Woodward is the worldwide leader in industrial energy control technologies, providing not only speed and load controls, but also emission, generator, compressor, turbocharger, and ignition controls for diesel and natural gas engines, gas and steam turbines; and electric power generation systems, including microturbines and fuel cells.

## Control Names

Controls were originally identified by a series of one to three letters signifying some distinguishing design concept [such as IC for Internal Combustion governor]. Additional letters were added to denote different types of the same control line. Then numerical suffixes were added to signify the work output of the governor.

Some early electronic control series were identified according to the assigned design project number [such as 2301 and 43027]. The company has also used acronyms or titles that attempt to match the product name to the anticipated control activity [such as SOGAV™ for Solenoid Operated Gas Admission Valve].

## Control Designations

These descriptions are both brief and general. For accurate and up-to-date information about any current control, see the appropriate product specification. Product specs for all current Woodward products are available on our website:

**[www.woodward.com](http://www.woodward.com)**

Inactive product lines are shaded. Note that some models within an active product line may not be currently sold, and that some models within an inactive line may still be sold under special circumstances.

In addition, some product lines (particularly hydraulic turbine controls) have been transferred from Woodward to GE Global Controls Services in connection with the sale of the Woodward Global Services business unit to GE Power Systems.

**1000 Dual Dynamics Control**—Analog electronic control for gas or diesel engines. Provides a second set of dynamics for large off-speed conditions.

**1700**—An early design of the EPG for use with the 8290 EPG control system.

**1712 EPG/1724 EPG**—Electric Powered Governor systems with 1.7 lb-ft (2.3 N·m) output and 12 or 24 volt input.

**1883 Gas Turbine Fuel Control**—A complex ballhead-hydraulic governor fuel valve which uses speed, compressor discharge pressure, and compressor inlet temperature to position a fuel valve which is part of the control.

**1889 Governor**—A 2.75 ft-lb (3.7 J) compensating ballhead governor. Similar in appearance to EG-3. Isochronous or droop operation.

**1907 Valves**—Large and small gas valves and large and small liquid fuel valves for use with gas turbines. The small valve is often equipped with a compressor discharge limiter. Valves are often sold in connection with an attached TM actuator.

**2000 Series Pumps**—Self-contained pump designed to supply oil pressure for hydraulic governors (right).

**2057 Governor**—Mechanical gas turbine control. Similar to PSG.

**2300 Digital Control**—Variant of the 2301D control that is a custom-programmable hardware platform.

**2301 Electronic Control**—Analog proportional signal system of engine control. Early models were built in modules and installed on system assemblies. The system could feature load sharing, process control, temperature compensation, and many other parameters.

**2301 Proportional Actuator**—A small actuator designed to operate without a governor drive, using fuel pressure as the energy source.

**2301A Electronic Control**—An improved 2301 control system that isolates the power supply and enhances features of the earlier controls. Control functions in 2301A and in later 2301 models tend to be concentrated in a single control, and assemblies are not usually necessary.

**2301D Digital 2301**—A digital version of the 2301A.

**2500 Control System**—A low-cost, analog speed control. Similar to the 2301 speed control. Requires separate load sensing and other accessories.

**2500 Load Sensor**—(see Generator Load Sensor)

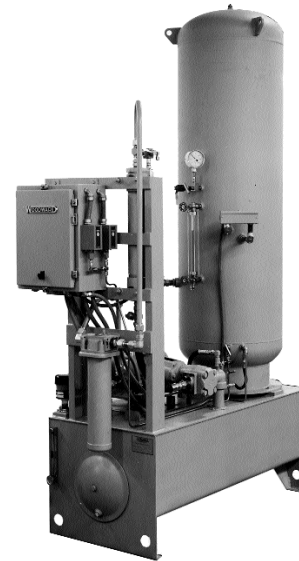
**301 Digital Sequencer**—A digital device designed to sequence prime movers in generation plants, particularly provides the long term control needed for warm-up and cool-down of gas turbines.

**3055 Hydraulic Pump and Manifold Plate**—A positive-displacement gear pump for industrial gas turbines, supplying hydraulic pressure to the fuel metering valve/actuator and variable stator vane (VSV) servovalve/actuator.

**3103 Rotary Gas Valve**—Designed for large, stationary gas turbines. Self cleaning, high temperature valve. Normally driven by TM-55P.

**3145 Liquid Valve**—A special fuel valve built for the LM500 turbine.

**3151A Water Valve**—A valve specifically designed to control the injection of high pressure water into a gas turbine to control NO<sub>x</sub>.



**3161 Governor**—A mechanical governor designed specifically for Caterpillar engines but also used on some other types of diesel engines. Features speed setting, fuel limiting, and shutdown options added to the cover. Uses an aluminum body with cast iron sleeves in the power bores.

**3171 Gas Valve**—A valve for metering gaseous fuel to industrial and marine gas turbines.

**3199 Actuator**—A proportional electro-hydraulic actuator for use with Woodward analog and digital controls (such as 2301A, 400, 43027, 501, 505).

**38 Liquid Valve**—Similar to the 1907 small liquid valve. Built at Woodward's Japan plant.

**400 Series Electronic Control**—Analog multiple-board modular control used primarily for vehicle or marine applications. Housed in a vibration-resistant waterproof box.

**4024 EPG**—Electric Powered Governor systems with 4.0 lb-ft (5.4 N·m) output and 24 volt input.

**43027 Electronic Control**—These analog systems were built primarily for turbine control, although a number of units were built for control of large engines. Each control consists of a number of plug-in modules.

**43095 Pneumatic Load Balance**—For use with governors which have pneumatic speed setting, to balance the load on multi-engine systems.

**500-series Digital Control Systems (DCS)**—Consists of a series of related programmable digital control systems: 501, 503, 507, 509, 511, 515, 517, 527, 537, and ContemPro. The series does NOT include the 505-series or the 5009 control, which are based on different hardware and software.

**5001LST/5009LST**—Variants of MicroNet control designed for large power generation steam turbine applications. 5009LST is fault-tolerant.

**5009 Fault Tolerant Control**—(see MicroNet)

**501 Digital Control System (DCS)**—Programmable control system for large engine and turbine control systems. Extremely flexible. Uses a selection of multiple electronic modules.

**503 Digital Control System (DCS)**—A combination of three 501 controls providing redundant continued control should any one system fail. Housed in multiple chassis. A fault-tolerant control system.

**505/505E Digital Governors**—Programmable control system for steam turbine applications. 505E designates a system designed for extraction steam turbine control. 505 controls use different hardware and software systems than do the other 500-series controls. The 505 is distinguished by the use of a single memory board and is built into a standard cabinet (right).

**505C Compressor Control**—Similar to 505, but designed for compressor applications.

**505CC-2**—Based on the 505/505E, but designed to control a single-valve or two-valve steam turbine and its one- or two-stage compressor load.



**505DE**—Based on the 505/505E, but designed to control double automatic extraction/admission steam turbines.

**505H Digital Governor**—Similar to 505, but designed for hydro turbine applications.

**505LST**—Similar to 505, but designed for large power-generation-based reheat steam turbines.

**507 Digital Marine Control (DCS)**—A 500-series digital control designed specifically to control multiple engine or turbine propulsion drive for marine service.

**509 Digital Control System (DCS)**—Digital control on the 500-series platform designed for the control of turbines driving compressors. A fault-tolerant system housed in a single chassis.

**511 Digital Control System (DCS)**—A single chassis 500-series digital control designed for standard applications of generators or compressors.

**512 EPG/524 EPG**—Electric Powered Governor systems with 0.5 lb-ft (0.7 N·m) output and 12 or 24 volt input (right).

**515 Steam Turbine Control (DCS)**—A special 500-series control designed and sold by Woodward's Japan plant.

**517 Digital Control System (DCS)**—A programmable 500-series control designed for hydraulic turbine control applications. Also called the Summit 517.

**524 EPG**—(see 512 EPG)

**527 Digital Engine Control (DCS)**—500-series programmable digital control designed for control of large reciprocating engines, and steam and gas turbines.

**537 Digital Engine Control (DCS)**—500-series programmable digital control designed for control of medium and slow speed engines.

**700-series Digital Controls**—Consists of a series of related programmable digital controls for reciprocating engines: 700, 700H, 701, 701A, 702, 705, 721, 723, 723PLUS, 828.

**700 Digital Speed Control**—A standard single-board engine control designed primarily for gas engines. Features set-point programming.

**700H Digital Speed Control**—Hydro turbine version of the 700.

**701 Digital Speed Control**—A standard single-board engine control designed primarily for medium-speed diesel engines.

**701A Digital Speed Control**—Enhanced version of the 701.

**702 Locomotive Control**—Designed to control diesel locomotive engines with hydraulic drives (primarily European rail engines).

**705 Digital Speed Control**—A standard single-board engine control designed for marine engines with mechanical drives.

**721 Digital Marine Control**—Marine control version of the 721.

**721 Digital Speed Control**—Enhanced version of the 700/701 with increased capabilities. Includes torsional filtering for engines driving generators through flexible couplings.

**723CAM**—3-D cam-blade positioner for hydro turbines.



**723 Digital Control**—Enhanced version of the 721 with increased capabilities.

**723H**—Hydro turbine version of the 723PLUS.

**723MP**—723PLUS-based manual back-up positioner for hydro turbines.

**723PLUS Digital Control**—Enhanced version of the 723.

**8256 EPG with 8290 Load Sharing and Speed Control**—An early EPG system.

**828 Digital Control**—Control based on the 723PLUS platform, programmable by a Woodward Distributor for special applications.

**8290**—An early EPG design.

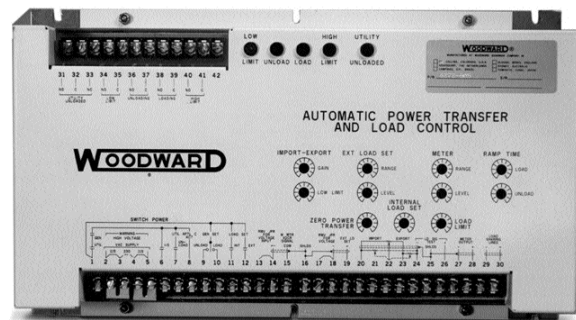
**ABLS**—Application Block Language Software. A software system used in connection with MOE for a number of digital controls.

**AGLC**—Automatic Generator Loading Control. The AGLC provides soft loading and unloading of generators through analog load-sensing electronics.

**APECS™**—The “Advanced Proportional Engine Control System” is a compact, isochronous, solid-state-electronic engine governor.

**APM Motor Control**—Advanced Permanent Magnet Motor Control converts most types of input voltage to variable dc voltage for the PM motor.

**APTL**—Automatic Power Transfer and Load Control. Analog control system to allow bumpless transfer on or off a utility bus. Has adjustable load and unload ramps. Usually used in conjunction with AGLC and automatic synchronizer (right).



**AtlasPC™/AtlasSC™**—Flexible, expandable, PC-based turbine and engine control. The AtlasSC control is a reduced version of the AtlasPC control.

**AutoBalancer™ 5000 Control**—A microprocessor-controlled fuel gas injection system that continuously balances power cylinder peak pressures in large bore two-stroke gaseous fueled engines. Major subsystems include the Gas Fuel Injection System (ElectroCam, including an In-Pulse fuel injection control, HPU, and EGAVs Electronic Gas Admission Valves), the Engine Health Monitor System (HealthChek), and the System Controller (a Smart 3000).

**Automatic Power Transfer Control**—A special control providing automatic breaker signals when loads between a generator and a bus are matched.

**CBG10**—10 ft-lb (14 J) compensated ballhead governor. Uses an EG-10 case.

**CLC™ Complete Locomotive Control**—A digital control system for rail locomotives. Designed to control engine speed, locomotive speed and power, wheel slip, smoke limiting, dynamic braking, air compressor, and generation excitation.

**ContemPro Digital Steam Turbine Control (DCS)**—500-series digital control designed for GE steam turbines.

**Control Assistant**—Software maintenance tool for Woodward's MicroNet and NetCon product lines. Provides additional functionality beyond variable viewing, including ability to perform advanced system diagnostics.

**CPC/Duplex CPC**—Current-to-pressure converter designed for positioning steam and fuel valves and associated servos.

**CSC Cummins Speed Control**—A variant of the EPG designed for precise control of Cummins diesel engines equipped with a PT fuel pump.

**D-1 Display**—Compact display unit for Woodward ignition systems, using a CAN-bus network interface.

**Digital Min/Max Flo-Tech™ (DMMF)/Digital Min/Max ProAct™ (DMMP)**—(see Min/Max Control System)

**Digital Reference Unit**—Digital reference units provide a variable signal output used to control the speed reference or other parameter on a governor. They are available with as many as three different set points.

**Digital Remote Final Driver**—Special function boards added to the more complex electronic engine and turbine controls.

**DPG 2100/2200/2300**—Electronic governor for diesel or gas-fueled engines in genset, load sharing, and off-highway applications.

**DSLCTM Digital Synchronizer and Load Control/MSLC Master Synchronizer and Load Control**—The DSLC control is a microprocessor-based synchronizer and load control designed for use on three-phase AC generators. The single unit includes these functions: synchronizer, load sensor, load control, dead bus closing system, VAR/PF, and process control. The MSLC is a master process control with these functions: synchronizer, utility load sensor, import/export load level control, and power factor control.

**DSM [Digital Speed Matching] Synchronizer**—(see Synchronizers)

**DSTC Digital Steam Turbine Control**—The DSTC is a self-powered, field-programmable, microprocessor-based control designed to operate single-stage industrial steam turbines.

**Dual Fuel Control**—Analog 2301 type control which can position both a gas and a liquid fuel actuator to proportion the fuel to an engine according to the availability of a fuel.

**Dyna 2000/2500/7000 Linear Actuators**—Compact, fast, all-electric actuators with only one moving part (Dyna 7000) or two moving parts (Dyna 2000/2500).

**easYgen™**—Compact, flexible, and configurable genset control (right).

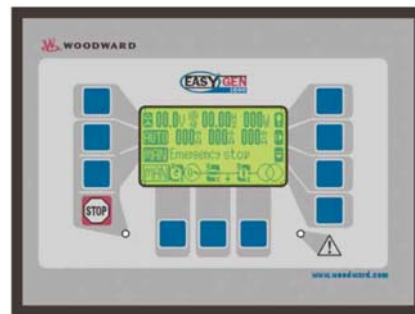
**EBV-100/100Plus**—The EBV (electrically-actuated bleed valve) is a modulating, high-temperature butterfly valve with an all-electric actuator for gas turbine air control.

**EG Load Signal Box**—A load-sensing box designed for use with the EGA and EGM controls.

### EG [Electric Governor] series

**Governors/Actuators**—Consists of a series of related electric governors/actuators: EG, EGA, EGB, EGM, EGR.

**EG-3C/EGR Actuators**—Actuator position is determined by a control signal that is nominally positive to increase fuel position and negative to reduce fuel position. The actuator holds a position when the control signal is at a nominal 0 voltage. The obsolete EGR does not have a terminal output but rather controls a remote servo with a flow of pressure oil. Units are compensated to provide system stability.



**EG-3P/EG-10P Actuators**—Convert 20 to 160 mA signals into proportional rotary output positions.

**EG-3PC/EG-6PC/EG-10PC Actuators**—Actuators are similar to EG-3P and EG-10P but have a compensation system which helps control with high number multi-viscosity oil from the engine.

**EGA Control System**—An analog electronic control which senses speed from the alternator frequency. Output of this control is integrating (positive to increase fuel, negative to reduce fuel). A predecessor of the 2301 proportional electronic control.

**EGB Governor Actuator**—An actuator/mechanical governor combination that provides a least-fuel position output from a ballhead governor and from an EG type transducer. EGB units are made with outputs ranging from 1 ft-lb (1 J) of work to 500 ft-lb (678 J). Also known as ballhead backup governors. Designed to have ballhead governor control even if the electronic signal is not available.

**EGCP-1/EGCP-2/EGCP-3/GCP-1**—Engine Generator Control Package. A microprocessor-based complete generator load control and engine management package designed for use with a Woodward speed control and a separate voltage regulator. Functions include: engine control, synchronizing, real (kW) load control, reactive (kVAR) control, automatic generator sequencing, protective features, and a PC interface.

**EGM Control System**—An analog electronic control which senses speed from a magnetic pickup. Output of this control is integrating (positive to increase fuel, negative to reduce fuel). A predecessor of the 2301 proportional electronic control.

**EGR Actuator**—(see EG-3C)

**EGS-01**—Digital Engine Management System for stationary gas engines.

**EHPC**—Electrohydraulic Power Cylinder, a servo-valve-operated power cylinder for use in positioning steam turbine steam valves (right).

**ElectroCam™**—(see AutoBalancer)

**EM-6P Actuator**—Electric powered actuator with 6 ft-lb (8 J) output. Similar to the EM-10P/20P but with gear drive rather than belt drive. Will accept a 20–160 mA control signal.

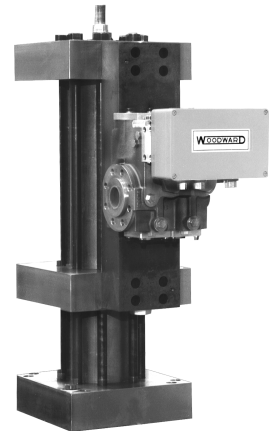
**EM-10P/EM-20P Electric Actuator and Driver**—10 and 20 ft-lb (14 and 27 J) output actuators with belt drive.

**EM-35 Analog Driver**—Electric motor driver converts a 4–20 mA input into a proportional output to a three-phase, brushless, dc motor.

**EM-70/EM-140 Rotary Output Electric Actuators and EM Digital Driver**—The EM actuators and driver are used to position engine fuel injection control linkage, flow control valves, and gas turbine variable geometry systems. The actuators consist of a rugged, high performance, brushless servomotor and a precision planetary gearbox.

**EM-80/EM-300**—Programmable, all-electric actuators that provide 40 degrees of actuator output rotation for large diesel, gas, and gasoline engines, and all types of turbines.

**EML-100**—Electric actuator designed to provide highly accurate, closed-loop position control of steam and fuel valves. Designed to be used with the Woodward EM Digital Driver.



**EPG**—Electric Powered Governor. Simple governor system that does not require a mechanical drive or hydraulic actuator. EPG systems include analog 512/524, 1712/1724, 4024, CSC, and digital ProAct actuator/governor.

**ESDR 4/4T**—Provides three-phase current differential protection for generators, motors, and transformers in unit connection.

**Excel<sup>®</sup> 150/Excel 250 Gas Turbine Controls**—The Excel 150 is a turbine model of the 721 control. The Excel 250 is similar to the 501 digital control.

**FireFly<sup>™</sup>**—Gas engine detonation detection control. Detects knock and adjusts the ignition timing to compensate.

**Flo-Tech<sup>™</sup> Integrated Actuator/Throttle Body**—An electrically-actuated throttle/valve (throttle body) which controls flow output, with an electronic driver to control the throttle/valve position.

**Flo-Tech<sup>™</sup> Speed Control**—Provides basic isochronous speed control for gas engines using the Flo-Tech Integrated Actuator/Throttle Body.

**GAP<sup>™</sup> Graphical Application Program**—Woodward-designed software, which operates in a Windows environment, used to configure many Woodward digital controls.

**Gas Shutoff Valve (GSOV)**—(see GSOV)

**GatePro<sup>™</sup> 700 Upgrade Kit**—Converts Woodward HR, LR, or LHR gateshaft governors to digital control. Includes a 700H digital control and an electro-hydraulic interface.

**GCP-1 Generator Control Package**—(see EGCP)

**GCP-10 Series/GCP-20 Series/GCP-30 Series Genset Controller**—Provides complete engine and generator control, including circuit breaker control logic.

**GECO<sup>™</sup> Gas Engine Control**—An inexpensive air/fuel ratio control for natural gas engines, designed to help engines meet tighter emissions standards (right).

**GenDec<sup>™</sup> Digital Engine Control**—A self-contained digital governor/actuator system designed for installation on certain Robert Bosch and other fuel injection pumps.

**Generator Load Sensor/Load Sensor/2500 Load Sensor**—A number of load sensors are used to allow isochronous load sharing between engines driving generators.

**Glo-Tech<sup>™</sup> Valve**—Wastegate/bypass valve capable of handling hot exhaust gasses of gas or diesel engines. Reduces emissions and increases efficiency and reliability.

**GS Gas Metering Systems (GS Driver/GS3/GS6/GS10/GS16)**—Electronic driver and all-electric gas metering valves designed to provide an interface between an electronic control system and an industrial gas turbine in the range 200 kW to 30 MW.

**GS25 Valve Driver and GS25 Valve/Actuator Assembly**—Integrated, direct-coupled system with valve position control, all-electric actuation, gaseous fuel flow regulation, and fault indication.

**GSOV/GSOV25/GSOV25HT**—Gas Shutoff Valves designed to provide gas turbine shutdown by rapidly halting the flow of gaseous fuel. The HT version can withstand higher fuel temperatures and back pressures.



**GTC100/190/200/250**—Based on the Atlas platform, the field-configurable GTC (Gas Turbine Control) provides robust control for single-shaft and two-shaft, single-fuel or dual-fuel gas turbine applications.

**GW 4 Gateway/Interface Converter**—Converts the CAN-bus protocol to one of several bus or interface protocols, and send the control data to a PC or PLC.

**Harvstmor™ Control System**—A load control system designed for use on agricultural combines. Analog electronics sense engine speed droop due to load increase and adjust the hydrostatic clutch to maintain engine load.

**HealthChek™**—(see AutoBalancer)

**HGV Hydraulic Globe Valves**—Integrated valve and actuator that controls the flow rate of natural gas fuel to various stages of a gas turbine combustion system.

**HPU Hydraulic Power Unit**—Modular packages designed to provide a hydraulic pressure system. Primarily used with turbine installations to operate TM actuators and related equipment.

**Hydraulic Amplifier**—Devices which provide amplified output from a position signal. Available in two different sizes (standard and large). Available with built-in EG-3 for position control from an electronic governor or may be mechanically controlled or pressure controlled.

**IC [Internal Combustion] Governor**—Large, ballhead-hydraulic governor. Functions are similar to the UG, which replaced it.

**IC-100 CD Ignition System**—Microprocessor controlled, spark capacitive discharge ignition system capable of supplying ignition energy for a wide range of gas engines with 1 to 8 cylinders.

**IC-900/IC-910/IC-912/TIS-910 Ignition Controller**—High-energy, software-based ignition system that can be configured from 2 cylinders to 24 cylinders.

**IGEM® Integrated Gas Engine Manager**—A digital control which uses a number of sensor inputs to provide control signals of the gas-engine fuel valve, manifold boost pressure and ignition timing. Designed for use of large, spark-ignited, natural-gas engines.

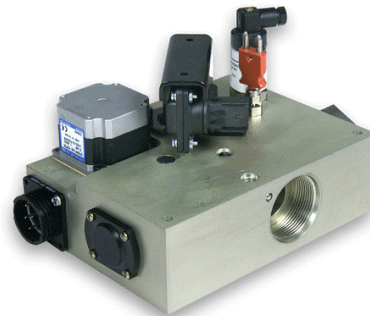
**I-H (Current to Pressure) Converters**—A method to convert the electronic output of a control device into a hydraulic pressure output.

**IKD 1 I/O Expansion Board**—Intelligent expansion board that allows an additional 8 discrete inputs and 8 relay outputs to be connected via CAN-bus to other Woodward controls (such as the GCP-30).

**Import/Export Control and Process Controls**—Similar analog controls which adjust electronic controls to desired loads according to a preset level.

**IMS100**—IMS (Integrated Metering System) controls the flow of gas or air to stationary fuel cell power plants in the 50 kW to 1.5 MW power range. Flow meters and valves are integrated into a single, compact package (right).

**In-Pulse™ Electronic Fuel Injection Control**—Programmable, electronic fuel injection control designed to control a range of Woodward electric low-pressure gas admission valves and electric-hydraulic high-pressure rail valves, for up to 20 injection inputs. The control is designed for engine skid mounting.



**L-Series**—Latest version of the LCS family, including speed controller, position controller, and integrated throttle body (right).

**LC-50/LCS/LCS ITB**—The LCS is a compact, on-engine electronic engine governor that contains both a rotary actuator and a controller circuit board in the same enclosure. The LCS provides a number of speed setting, speed biasing, control, fuel limiting, diagnostic, and datalink functions for stationary industrial applications. The LCS ITB adds an integrated throttle body, and the LC-50 combines the LCS with an integrated gas mixer and throttle body.



**LEC Locomotive Engine Control**—A digital control designed to replace the PG rail governor. Controls speed and generator excitation. Has notch speed setting, water and oil shutdown capabilities.

**LinkNet<sup>®</sup>**—Low-cost, easy-to-implement, distributed I/O network, used mainly with 723/723PLUS/828/DSL/MSLC/In-Pulse controls. Formerly called QuadraLink.

**Liquid Shutoff Valve**—Designed for turbine fuel supply protection. Valve operates positively on the fuel supply pressure.

**Load Pulse Sensor**—A 2301 type device that anticipates load changes on a generator system and biases the speed control to match the load before the generator has caused the speed to change.

**Load Sensor**—(see Generator Load Sensor)

**LQ/LQ6/LQ25T Liquid Fuel Metering Valve**—Fast, all-electric liquid fuel metering valve for gas turbines.

**LS 4**—The LS 4 provides breaker protection, synchronization, and load control. For complex switchgear applications, each breaker is equipped with an LS 4, which measures the three-phase voltage on each side of the breaker. The LS 4s communicate with each other and with the GCP-31 control via CAN-bus to control utility feeder breakers or tie breakers.

**LSG Load Sharing Governor**—An early model of electronic governor system. The LSG mechanical governor and electronically controlled electric actuator is the forerunner of the EGB governor. The electronics in the system sensed load from the generator. All speed control was with the ballhead governor portion.

**MFR-2/3/11/12/13/14/15 Multi-Function Relay**—Provide monitoring and protection for a wide range of power generation and distribution applications.

**MI-04**—Closed-loop fuel control with adaptive-learn technology provides drive-by-wire throttle system for forklifts and other alternative-fueled off-highway vehicles. Field-extractable fault codes with diagnostics available via CAN. Designed to help OEMs meet legislated TIER-2 emission levels.

**MicroNet™/MicroNet™ TMR**—Programmable digital control for gas, steam, and hydro turbines, and for diesel and gas engines. Has simplex and TMR (triple modular redundant) versions. 5009 Fault Tolerant Control is a specific version of the MicroNet TMR. MicroNet replaces the functionality of the 500-series.

**Min/Max Control System/Digital Min/Max Control System**—Systems designed for use on compressed natural gas buses. The analog Min/Max drives a 1724 actuator. The Digital Min/Max drives a Flo-Tech or ProAct actuator.

**MOE™ Menu Oriented Editor**—A Woodward software system that permits programming of digital devices through the editing of prescribed menus.

**MOP Motor Operated Potentiometer**—Devices using small electric motors to turn potentiometers, which in turn usually adjust the reference speed in electrical governors. Available in many models, some with cams which trip micro switches at given points.

**MPU Magnetic Pickup**—A device which produces an electrical output when its magnetic field is interrupted by an iron gear tooth. Provides the speed signal for most electronic governors.

**MSLC Master Synchronizer and Load Control**—(see DSLC)

**NetCon® 5000**—A digital 32-bit microprocessor control with advanced memory system. Designed for turbine control. Engine control versions called Smart.

**NetSim™**—Software for conducting simulators in conjunction with GAP, without the need for hardware in the control loop.

**OH1**—Controls heavy-duty, lean-burn natural gas engines in urban buses and trucks and other alternative-fueled on-highway vehicles. The highly accurate, closed-loop control system helps OEMs meet legislated emissions levels, while maintaining diesel-like drivability and excellent fuel economy.

**OpFamily® (OpPanel®/OpPanel® Plus/OpTrend®/OpTrend® Plus/OpView™)**—Windows-based operator interfaces that function as annunciators, operator control panels, data loggers, trending packages, and engineering stations for Woodward 500-series and NetCon controls.

**PA100L Pneumatic Actuator**—100 ft-lb (136 J) linear output. Actuator particularly designed for use in hazardous environments. Uses torque motor to control shop air for position.

**Peak® 150 Digital Control**—Programmable, digital electronic control for single-valve or single-valve-rack steam turbines (right).

**Peaking Load Control**—An early version of an SPM synchronizer. Designed to load supplementary engines onto a utility bus during peak load periods.



**PG [Pressure Governor] series Governors/Actuators**—Consists of a series of related electric-hydraulic governors/actuators. Governors include: PG, PG-EG, PG-PH, PG-PL, PG-TR, PGA/PGA-EG, PGA-TL, PGD, PGE/PGEV, PGG/PGG-EG, PGL, PGM-EG, PGTM. Actuators include: PG-12R/PG-12L Actuator, PGPL Actuator/Driver.

**PG Governor**—Standard PG pressure-compensating hydraulic governors with linear or rotary output ranges from 12 to 500 ft-lb (16 to 678 J).

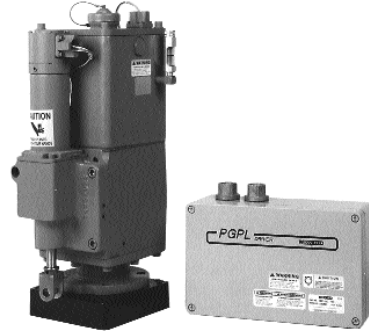
**PG-12R/PG-12L Actuator**—The PG-12 actuator converts a 0–200 mA electric input signal to a proportional linear or rotary hydraulic output-shaft position. Work output is 18.7 ft-lb (25.4 J) in the increase direction, and 14.9 ft-lb (20.2 J) in the decrease direction.

**PG-EG Governor**—PG governor/electric actuator combination.

**PG-PH Governor**—PG power house governor, allowing remote adjustment of the speed reference.

**PG-PL Governor**—PG pipeline governor. Isochronous governor originally used in pipeline applications.

**PGPL Actuator/Driver**—An electric-hydraulic actuator with a proportional driver interface. The driver receives a 0–200 mA input, and available actuator outputs are 12, 29, and 58 ft-lb (16, 39, and 79 J) linear, or 29 ft-lb (39 J) rotary (right).



**PG-TR Governor**—PG governor with transducer receiver for setting speed with a current input.

**PGA/PGA-EG Governor**—PG governor with air speed setting, used extensively in marine applications. PGA-EG has an electric actuator.

**PGA-TL Governor**—PGA governor with torque limiter for increased engine life.

**PGD/PG Dial Governor**—PG governor with dial speed setting.

**PGE/PGEV Governor**—PG pressure-compensated rail governors with electric speed setting. PGEV has vane servo (which controls the excitation voltage to the diesel-electric engine generator set).

**PGG/PGG-EG Governor**—Replaces the PG-PH governor. PG governor with remote speed setting. PGG-EG has an electric actuator.

**PGL/PG Lever Governor**—PG governor with lever speed setting.

**PGTM Actuator**—PG governor with torque motor, primarily for marine use.

**Pitch Control for Marine Propellers**—A load control device used in conjunction with a PGA governor to automatically set desired pitch on marine propellers. The pitch control uses vane servo rather than power pistons to position output

**Pneumatic Transmitter**—A device used with certain PGA governors to permit load sharing with a single pneumatic speed setting.

**Power Flow**—Integrated, all-electric valve/actuator designed for throttling the intake of internal combustion engines, including fuel injection.

**Power Sensor (Real and Reactive)**—Analog accessory used to set load on generator sets.

**Precise Frequency Control**—A 2301 type device which reads generator frequency and biases the 2301 speed setting to maintain the exact frequency over extended periods.

**ProAct™-series Controls**—Consists of a series of related all-electric actuators: ProAct I/II/III/IV Actuator/Driver, ProAct mA Digital Speed Control; plus the newer “Gen 2” controls: ProAct Analog and ProAct Digital Plus.

**ProAct™ I/ProAct™ II Actuator/Driver**—A programmable electric powered actuator system designed for diesel and gas engines. Provides 2.6 or 5.2 ft-lb (3.5 or 7.1 N·m) work over 75° of rotary output.

**ProAct™ III/ProAct™ IV Actuator/Driver**—All-electric actuator system designed for larger diesel, gas, and gasoline engines. Provides 10 or 20 ft-lb (14 or 27 N·m) work over 75° of rotary output.

**ProAct™ mA Digital Speed Control**—A programmable, digital electronic control, used with the ProAct II/III/IV and ProAct Driver to control the speed of diesel and gas engines.

**ProAct™ Analog**—Electric actuator designed to be mounted on-engine.

**ProAct™ Digital Plus**—Similar to the ProAct Analog, but containing an integral digital driver.

**ProAct™ Gen 2**—Newer version of the ProAct controls, consisting of the ProAct Analog and ProAct Digital Plus.

**ProTech® 203 Overspeed Protection System**—Electronic, triple-redundant overspeed monitoring and emergency shutdown device. Uses digital speed sensing, and two-out-of-three voting, with separate power sources for each speed-sensing unit.

**PSG [Pressure Compensated Simple Governor]**—SG-type governor with compensation allowing isochronous operation. Will also operate in droop with externally adjustable droop available.

**QuadraLink™**—(see LinkNet)

**Raptor**—A gas regulation and metering valve/actuator system for Caterpillar.

**Remote Final Driver**—(see Digital Remote Final Driver)

**RPFV Rail Pressure Fuel Valve**—Special self-contained governor system designed for installation on certain Cummins engines.

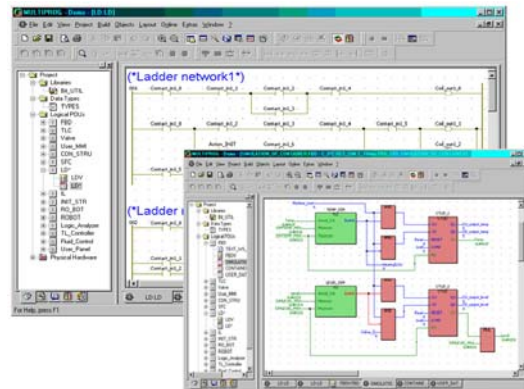
**SG [Simple Governor]**—A droop-type governor for small engine or turbine control. SG governors are also available for overspeed trip devices. Rotary or linear output.

**SG 2D Digital Speed Control**—A digital electronic engine speed controller used to control a fuel feed actuator on an internal combustion engine, capable of operating as either a standalone frequency controller or as a subordinate controller.

**SGT Governor**—SG governor with torque converter. Ballhead governor provides a low-signal select output from an engine drive and a separate flex shaft drive from a torque converter.

**SI [Steam and Internal Combustion Governor]**—Similar in appearance to the PG governor. The SI governor featured compensation with a separate pilot valve bushing which was moved by compensating oil.

**SLE Sequence Logic Editor**—Versatile, application development software tool used to generate, view, and debug logic code for Woodward's AtlasPC™ and MicroNet™ platforms. Any of five different programming languages can be used to create system logic code (right).



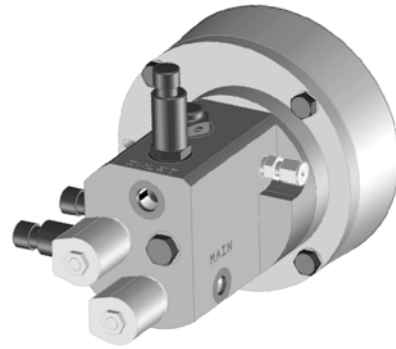
**SM [Speed Matching] Synchronizer**—(see Synchronizers)

**Smart™ 1500/Smart™ 2000/Smart™ 3000**—Digital engine controls, similar to 501 and NetCon 5000, with software designed for engine control rather than turbine control.

**SmartIFS™ Integrated Fuel System**—Combines fuel valves, sensors, and FMS (fuel management system) into a factory-assembled and calibrated system that provides numerous functions via a modular design.

**SmartPanel™/SmartTrend®**—Operator panel and software interface for use with some Smart controls.

**SMP Smart Metering Pump System**—Variable speed pump system that eliminates the metering valve and differential pressure regulator for turbines up to 10 MW. Reduces cost and complexity. Core components include a positive displacement fuel pump, motor, variable speed driver, and pump monitor and compensation system (PMCS) (right).



**SOGAV Solenoid Operated Gas Admission Valve**—An electrically actuated, high response gas admission valve for in-manifold (port) fuel admission. Designed for four-cycle, turbocharged, natural gas or dual-fuel engines. Models for a variety of bore ranges.

**SonicFlo™ Gas Fuel Control Valve**—Controls the flow of gas fuel to the combustion system of an industrial or utility gas turbine. The design integrates the valve and actuator into a compact assembly, and provides a linear flow characteristic unaffected by discharge pressure.

**SPC Servo Position Controller**—Electronic servo-valve driver that accepts a DeviceNet or 4–20 mA based position demand signal from a system controller, and accurately positions proportional or integrating servo-valves.

**SPM/SPM-A/SPM-D Synchronizers**—(see Synchronizers)

**ST-125™ Control System**—Co-designed with Stanadyne for isochronous control of the Stanadyne DB-4 series high-speed diesel injection pump. Includes an integrated, bi-directional drive actuator and separate analog speed control.

**STExcite™**—High-energy ignition driver that interfaces with flexible ignition leads and igniters to provide the ignition system of industrial gas turbines.

**Streamline™**—Family of carburetors, regulators, lockoffs, and other components for LPG and natural gas fueled engines.

**STS100 Steam Turbine Simulator**—Based on a Woodward 723 platform, the STS100 provides closed-loop simulation with Woodward's 505, 505E, and 5009 steam turbine control systems, using actual field data.

**Summit 517 Digital Control System (DCS)**—(see 517 Digital Control System)

**Swift™ Gas Metering System**—Gas metering system for high-pressure fuel cells and for micro-, mini-, and small industrial turbines. Includes metering valve, electronic valve driver, and shutoff/sensor module.

**SwirlFlash Water Injection System for Gas Turbines**—Produces extremely small droplets into the inlet of a gas turbine compressor, to increase power output by 10–20%, increase efficiency by 1–2%, and reduce NO<sub>x</sub> emissions.

**Synchronizers**—Speed and phase matching systems used to control electronic governor speed setting and permit automatic synchronization between a generator and a bus. Older versions include the SM (speed matching only) and SPM. The SPM-A is a more versatile version of the SPM. The SPM-D is a microprocessor-based synchronizer. The DSM (digital speed matching) is designed for power generation systems driven by steam or gas turbines.

**SynconPanel Transportable Remote Synchronizing Panel**—Remote synchronizing panel that transfers a local measured delta between two voltage systems via CAN-bus to a genset control.

**TA-10P/TA-20P Turbine Actuators**—Torque motor controlled hydraulic actuators identical to the UA actuator, except specifically supplied for a turbine application.

**TecJet™**—Electronic gas injection valve for single-point injection. It has integrated sensors and electronics, which provide the correct gas flow under all circumstances (right).

**TG Turbine Governor/Actuator**—A simple droop governor designed specifically for high-speed turbine control. Available with 10, 13, and 17 ft-lb (14, 18 and 23 J) outputs. Also used on some Ajax engines.



**TIS-910 Ignition Controller**—(see IC-900)

**TM Actuator**—Torque motor controlled hydraulic actuators. Available in a number of sizes, rotary or linear output. Primarily used to position fuel or water valves on turbines.

**TQ-125™ Engine Control**—An integrated speed control and actuator in a compact engineering plastic case, designed for high-speed engines requiring a 0.25 ft-lb (0.34 J) actuator. Bi-directional, limited angle torque actuator, input from MPU or ignition coil, switchable dynamics, 50/60 Hz switch.

**TrackTion Master™ Control**—A digital wheel slip control system for rail locomotives, based on the PLC platform.

**TUG 4 Temperature or Analog Input Monitoring Unit**—Directly connects up to 16 analog sensors for direct measuring of temperature or other analog signals measurable with 20 mA sensors.

**UA Universal Actuator**—A torque motor controlled actuator. Converts a 20–160 mA control signal into an output position. Available in 10 and 20 ft-lb (14 and 27 J) models, rotary or linear output.

**UA12R/UA12L**—UA Actuator for railroad engine control. A UA actuator specifically designed for use on rail engines, with PLC or LEC digital locomotive controls. Designed to directly replace a PGE or PGEV governor.

**UG MAS**—A UG governor with milliamp speed setting.

**UG Universal Governor**—A line of pressure compensated governors, with work output from 5.7 to 40 ft-lb (7.8 to 54 J). Adjustable compensation, adjustable droop or isochronous.

**UG-Actuator**—A TM-pilot valve actuator built in a UG case for direct replacement of a UG Governor with an electronic governor system. Has self-contained sump, other UG features. In 8 and 40 ft-lb (11 and 54 J) versions.

**UMT 1 Measuring Transducer**—Measures true RMS values on electrical three-phase systems with current and voltage measuring inputs, to calculate the values for real, reactive, and apparent power, power factor, kWh, and kVarh.

**Variable Stator Vane Control (VSV)**—A ballhead device designed to control the vanes in a two-stage gas turbine according to speed of the compressor section.

**Watch Window/Watch Window II**—Woodward-designed software for monitoring and tuning control variables, uploading/download tunable variables, and downloading new programs to the control.

**WO**—Small, self contained ballhead-hydraulic governor built in the 1930s. Dashpot compensated for isochronous or droop.





**We appreciate your comments about the content of our publications.**

**Send comments to: [icinfo@woodward.com](mailto:icinfo@woodward.com)**

**Please include the manual number from the front cover of this publication.**



PO Box 1519, Fort Collins CO 80522-1519, USA  
1000 East Drake Road, Fort Collins CO 80525, USA  
Phone +1 (970) 482-5811 • Fax +1 (970) 498-3058

**Email and Website—[www.woodward.com](http://www.woodward.com)**

**Woodward has company-owned plants, subsidiaries, and branches,  
as well as authorized distributors and other authorized service and sales facilities throughout the world.**

**Complete address / phone / fax / email information for all locations is available on our website.**