



F U E L I N G P R O G R E S S

Power Management Solutions

 WOODWARD

At the Heart of the System

Deregulation is a reality. The face of the power industry has changed dramatically. Electric power users are now demanding the **lowest possible price** and power producers therefore are demanding **optimal performance** from all of their generation assets. Globally, the industry is facing rapidly increasing demands for power and a growing awareness that the needs must be met with "Green Power."

Woodward Industrial Controls designs and manufactures a range of analog and digital power management controls that meet the many diverse needs of the power generation industry. From base load or process control, to peak shaving and emergency power or communications intensive distributed power generation requirements. Additionally, Industrial Controls is one of the **world's largest independent suppliers** of fuel systems and controls for gas and diesel engines and industrial turbines. Industrial Controls offers a

Maximize your **FLEXIBILITY** and
EFFICIENCY and reduce your **EMISSIONS**

range of power management and prime mover controls for large and small applications and can apply sophisticated on-engine hardware and control software to make power generation as **efficient and environmentally friendly** as possible.

Through the ability to provide control over both the generator and the prime mover, Industrial Controls can help power generators provide consistently **reliable power** and coordinate a variety of distributed resources.



Real world solutions

The accumulated knowledge gained over decades of working on prime movers and developing, manufacturing, and applying, **Core Fuel and Combustion Control** solutions for precision control of fuel, air, and unit control make us unique.

No other vendor can offer the depth of expertise and experience specifically in the area of controlling engines and turbines and their driven loads. Industrial Controls is committed to meeting customer requirements for highly sophisticated, user-friendly controls and hardware while constantly striving to drive down cost. The ability to design and manufacture both control and fuel system components and apply specialized software and I/O to the demanding engine and turbine environment combine to make Woodward the obvious choice.

WOODWARD offers you a **GREATER** depth of **EXPERTISE** and **experience**

Today Woodward ICG offers a complete range of power generation controls, actuators, valves, fuel delivery systems, and digital controls and is utilizing **cutting-edge technology** to produce the next generation of solutions.

Power Management

- Automatic Sequencing
- Gen-Set Synchronizing
- Real kW Load Control
- Reactive kVAR Control
- Isochronous Load Control
- Import/Export
- Load Sharing

Generator Monitoring and Protection

- Over/Under Voltage & Frequency
- Reverse Power
- Loss of Excitation
- Overspeed
- Overcurrent
- Speed/Frequency Mismatch
- Load Surge
- Loss of Mains

Engine Monitoring and Control

- Engine Starter Sequencing
- Speed Control
- Fuel Control
- Pre-Glow
- Controlled Cool-Down
- Monitoring (Oil Pressure, Water Temp, Battery voltage)

On Engine Components

- Valves/Pumps
- Fuel Injection (EFI)
- Actuators and Governors
- Networked Engine Control
- Integrated Generator Control

Turbine Control

- DLE Fuel Systems
- Fuel Nozzles
- Electrical and Mechanical Actuation
- Integrated Fuel Skids
- High Temp/Pressure Valves
- Distributed I/O
- Simplex and TMR Control Systems
- Networked (Smart) Turbine Control
- Control Software Expertise
- Complete Software Tool Suite
- Compressor/Gen Set Integration



A Full Range of Controls and Fuel Systems for All Types of Engines and Turbines



Small Gas Turbine Control



Diesel and Gas Engine Controls

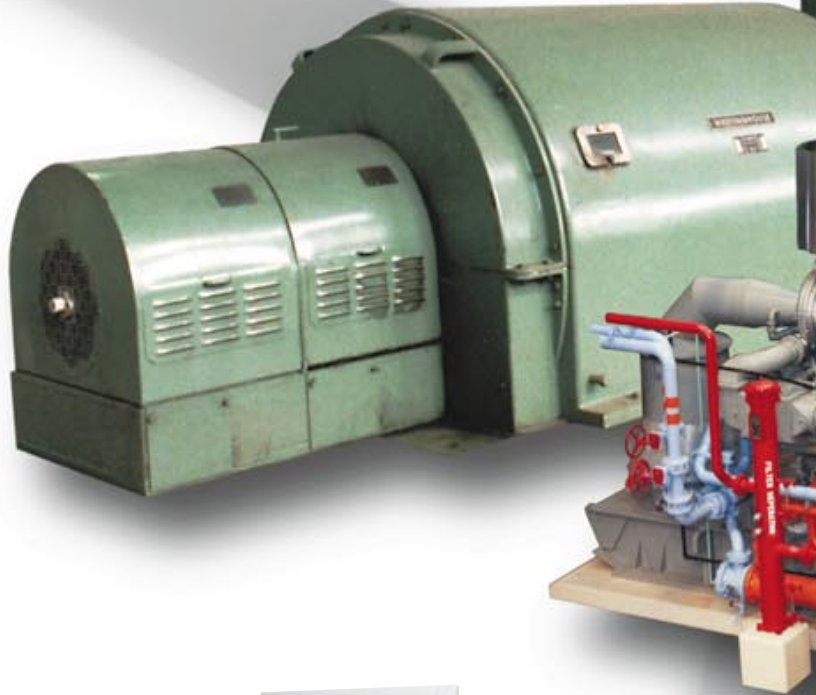


Core Fuel and Combustion Control



GAP™ Software Flexibility

The application-level programs in Industrial Control's programmable products are created with GAP™ (Graphical Application Programmer). Designed specifically for use in engine and turbine applications, this tool is an intuitive, Windows-based, drag-and-drop programmer that utilizes a library of pre-defined and fully tested application blocks. The real power of GAP is in its flexibility. For example, an engineer can easily make and document value-added changes in the package control and sequencing without worrying about effecting the integrity of the core fuel control. It is, therefore, very easy to add or change functionality.



Integrated Engine/Generator Controls



Digital Synchronizer and Load Control



Digital Load Sharing and Speed Controls



Engine/Generator Control Package



Analog Load Sharing and Speed Controls



Steam or Hydraulic Turbine Control



Large Gas or Steam Turbine Control



Automatic Generator Loading Control



Analog Synchronizer

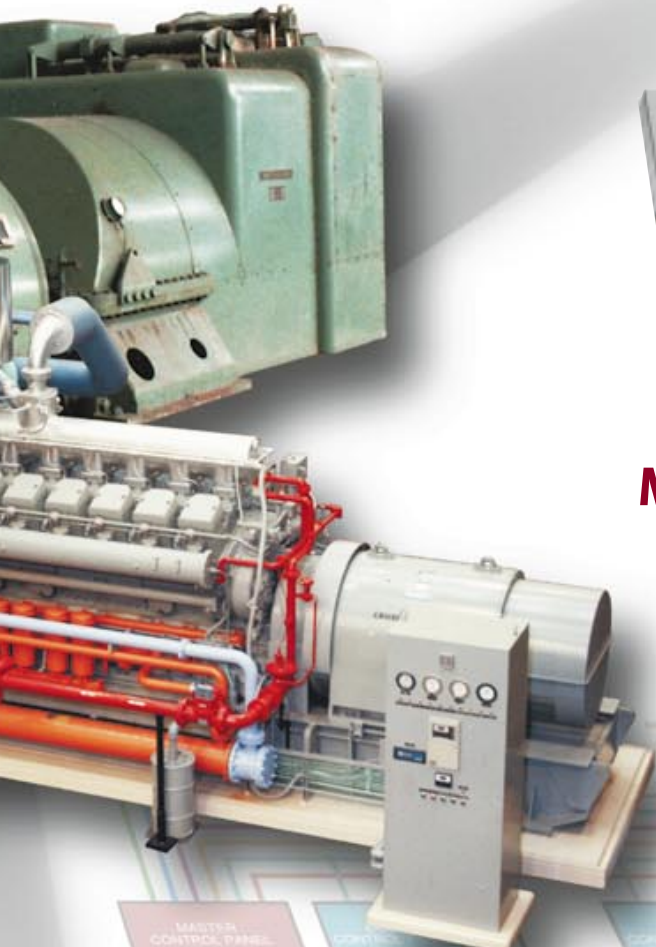


Real Power Sensor



Load Sharing Modules

Power Management Auxiliaries



Distributed Power Generation

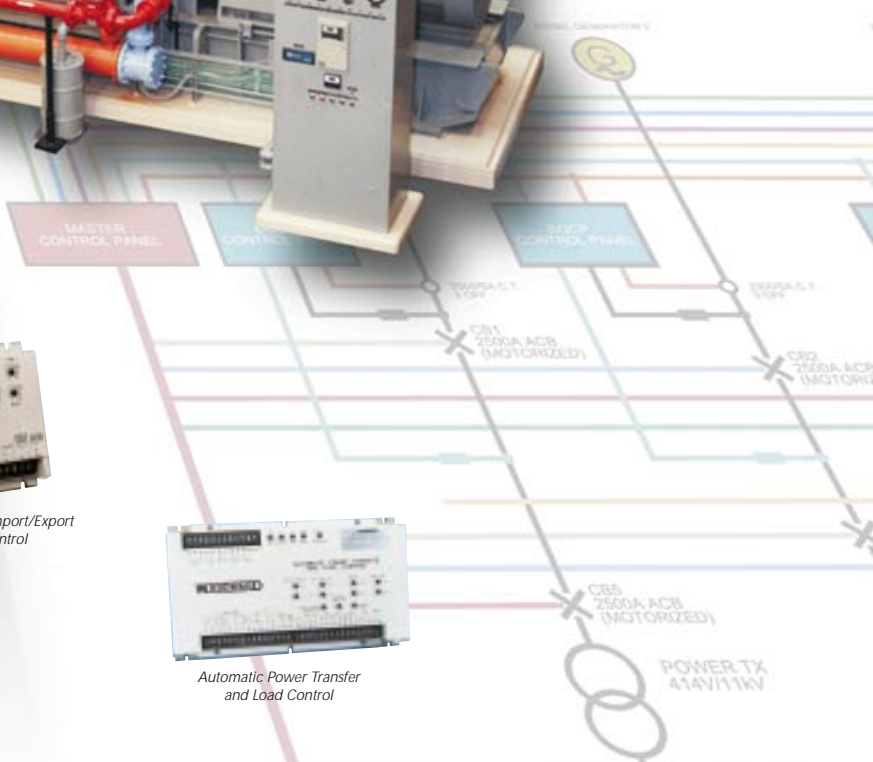
The concept of distributed power generation refers to the ability to use and manage power generation resources at or near the point of consumption. Woodward's Atlas, an industrialized PC based modular control is fully capable of remote dispatch and monitoring. This allows the power user to immediately and remotely engage back-up or standby generators or peak shaving units. Power users are easily able to deal with problems on the grid and therefore greatly increase their power reliability. An Atlas based, integrated control allows the user to control both the turbine and the generator through one easy to use control. Everything needed to get back or stay on-line is right there.



Process Import/Export Control



Automatic Power Transfer and Load Control



ISO 9001 Six Sigma

Quality—It's a way of life

With decades of experience in designing, manufacturing, and applying actuators, governors, valves, and engine control systems, Industrial Controls has established itself as a dynamic leader in the Gas and Diesel engine market.

Our reputation has been built on the quality and reliability of our products, our extensive manufacturing capabilities, our global support, and our unmatched service.

However, if our customer is not successful, Woodward is not successful, therefore Woodward emphasizes customer satisfaction in four important areas known as **QDRC**:

Quality. The first time, every time. This is our first priority.

Delivery. On-time delivery so you get our products when you need them.

Responsiveness. We respond to your needs without delay.

Cost. We constantly strive to reduce costs.

We intend to reach our QDRC goals by systematically applying **Six Sigma** methodologies to all of our processes. Today all of these characteristics are being enhanced by Woodward's



corporate-wide implementation of the Six Sigma quality philosophy.

Additionally, to help ensure the success of our customers, Industrial Controls or our sister group **Global Services** can provide:

- Engine/System modeling
- Application engineering support
- Extensive standard and custom training programs (Global Services)
- Worldwide service and technical assistance (Global Services)

Six Sigma is a philosophy of continuous improvement focused on reducing process variation and increasing the robustness of product designs. It relies on an improvement strategy that is used by all employees to improve the quality of products, services, and processes.

Quality Responsiveness delivery



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Industrial Controls
 *Recognized Turbine Retrofitter*