WOODWARD

AtlasPC™
Turbine and Engine Control System

APPLICATIONS

The AtlasPC™ control system is a new generation of turbine and engine control that provides the power of PC technology in a rugged and deterministic system. The flexible and powerful software tools and exceptional computational power make the AtlasPC control an ideal solution for controlling a variety of Prime Movers:

- Industrial Gas Turbines (large and small)
- Aero-derivative Gas Turbines
- Gas and Diesel Engines
- Steam Turbines
- Hydro Turbines

The AtlasPC control is well suited to many specific applications:

- Combined Heat and Power
- Generator Applications—Main, Peak, Stand-by, Marine
- Mechanical Drive—Compressors, Marine
- Any Application Requiring a Low Cost, Powerful and Rugged Control

The AtlasPC control system scales up and down extremely well. Through field bus expansion, the system fits almost every application. Whether used as a core fuel control or an entire package control, the AtlasPC system is the solution.

DESCRIPTION

The AtlasPC control is a powerful and rugged industrial control with embedded PC technology and dedicated I/O for real time control of turbines and engines. At the heart of the small and powerful AtlasPC platform is an industrial Pentium processor with Real Time Operating System (RTOS). The AtlasPC platform utilizes the industry-standard PC/104 bus structure to leverage "PC Economics," resulting in lower costs and greater feature flexibility.

AtlasPC control system environmental specifications allow it to move out of the control room and closer to the prime mover, even on the turbine skid in many cases. It is generally bulkhead mounted in an enclosure (see Environmental Specifications). Engineering and service interface is through serial or Ethernet ports. An optional display and keypad may be added to provide a limited local interface (future—check for availability).

The AtlasPC control contains on-board I/O optimized for prime mover control. The performance of these channels gives precise turbine and engine control not always possible with general-purpose I/O products. Configurability on many channels maximizes flexibility and channel usage, usually offering the least expensive I/O choice available.

Where additional I/O expansion is required the AtlasPC platform makes use of a field bus networking strategy. Field bus networks like Profibus DP or Ethernet (TCP/IP Modbus) are used to distribute I/O and smart devices from a variety of different vendors. Entire package control, including auxiliary sub-system control, system monitoring, and overall sequencing, becomes very economical.

AtlasPC CONFIGURATIONS

The AtlasPC control system supports two bus technologies and two "stacks" of modules, the PC/104 stack and the Power Bus stack. The modules utilize connectors that build the bus structure as they are stacked together. See the graphic next page.

Each bus structure supports different types of modules. The PC/104 stack uses the PC industry PC/104 standard and supports most I/O modules, the Pentium processor, and the communications modules. The Power Bus stack supports the power supply and limited I/O modules.

- Powerful real time PC control for turbines and engines
- Low cost—sensible alternative to a general purpose PLC
- Produced and backed by Woodward—turbine and engine control experts
- Pentium processor provides exceptional processing power
- Real time multi-tasking operating system with deterministic update rates
- Fast, accurate on-board I/O modules
- Profibus and other field bus options for additional I/O expansion
- Excellent networking capabilities
- Scalable from core fuel control to total package control
- Generator synchronizing and power management functions optional
- CE compliant, suitable for hazardous locations (see Environmental Specifications)

Modular construction allows considerable flexibility in meeting market requirements. Module options are listed at the end of this document.
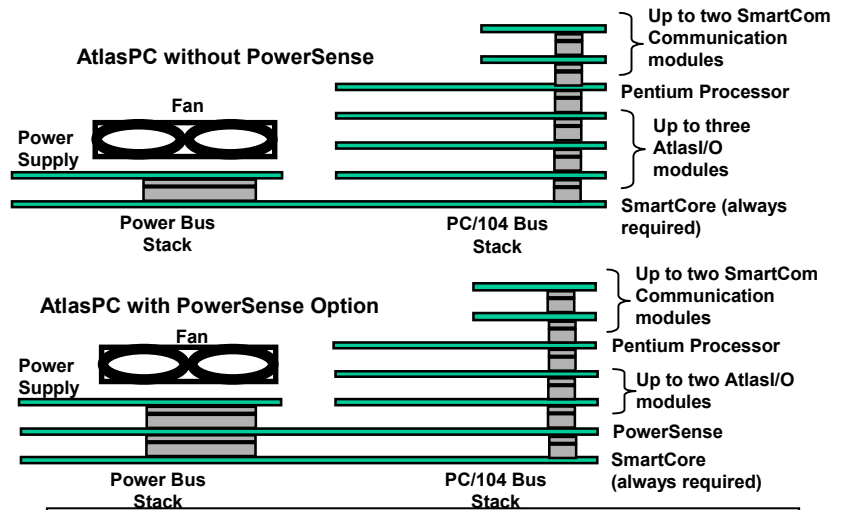
Every system contains the "SmartCore" module that bridges the power bus and the PC/104 bus. It contains I/O required by many prime mover control applications.

The PowerSense board is a specialized I/O module for Generator Control including Synchronizing, Load Management, and Load Control. PowerSense extends across both bus stacks.

"AtlasI/O" personality modules are placed on the PC/104 bus stack to tailor the AtlasPC control to the particular needs of certain market segments. Up to three AtlasI/O modules may be used (two if PowerSense is present).

The Pentium CPU Module always sits on top of the AtlasI/O modules on the PC/104 stack. One or two small "SmartCom" Communications Modules (such as Profibus DP Master) can stack on top of the Pentium.

The "Power Bus" distributes power to the control. The power supply provides regulated power for the AtlasPC control and also contains the relay driver outputs.

AtlasPC without PowerSense

Fan

Power Supply

Power Bus Stack

PC/104 Bus Stack

Up to two SmartCom Communication modules
Pentium Processor
Up to three AtlasI/O modules
SmartCore (always required)

AtlasPC with PowerSense Option

Fan

Power Supply

Power Bus Stack

PC/104 Bus Stack

Up to two SmartCom Communication modules
Pentium Processor
Up to two AtlasI/O modules
PowerSense
SmartCore (always required)

High Performance On-board I/O
AtlasPC on-board I/O is optimized for prime mover 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

PROGRAMMING AND SIMULATION

The AtlasPC control makes use of the same powerful and proven tools used by all of Woodward's PC control systems. Engineers create powerful and flexible programs through the IEC 1131-3 programming environment:
- Function Block Diagrams—through Graphical Application Program (GAP™)
- Sequential Function Charts—through Graphical Application Program (GAP)
- Structured Text
- Ladder Logic (On-line Programmable)

GAP™ (Graphical Application Program) software is Woodward's pictures-to-code programming tool. GAP software accesses libraries of control objects to quickly and efficiently implement complex (or simple) control strategies. The GAP environment lets application engineers concentrate on system level control rather than software coding details.

NetSim™ software is the virtual simulation environment for testing AtlasPC code without hardware in the loop. NetSim software links prime mover and package models (created in standard modeling packages—MatLab/Simulink, MatrixX, ACSL) to the GAP environment. With NetSim software, the control code can be completely tested in the office before field commissioning begins. The performance of NetSim software is optimized to provide simulation results that correlate very tightly to actual field results.

The AtlasPC control's programming and simulation tools are optimized for controlling turbines and engines, and their driven loads. Rather than providing a generic environment that is adaptable to any industrial automation requirement, GAP and NetSim software are specific. The libraries of supported functions have been proven over many years and countless applications.

Woodward's worldwide organization has unequaled turbine and engine control expertise. To support its OEM and Packager customers, Woodward can supply software tools, or entire solutions, or a variety of options in-between.

REAL TIME OPERATING SYSTEM (RTOS)

The AtlasPC control system utilizes the same field-proven real time operating system (RTOS), as the MicroNet™ NT control. The RTOS utilizes the power of Windows NT together with Venturcom's RTX real time extension.

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

The GAP/NT RTOS has leveraged the power of Windows NT while ensuring the highest reliability. Unnecessary components of Windows NT are removed to reduce the footprint size and complexity. All required drivers have been extensively tested for robustness and inability to affect system reliability or real-time control. To ensure integrity, no unapproved drivers can be added.

CONTROL AND PLANT LEVEL COMMUNICATIONS

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

Protocols Supported:
- Modbus (RTU and ASCII) over serial or Ethernet
- Ethernet TCP/IP
- Ethernet UDP
- OPC (Ethernet)—OLE for Process Control
- DDE Dynamic Data Exchange (serial)
- EGD (Ethernet)
- Additional Communications Options may be available—check with Woodward.

FIELD BUS INTERFACE

Field bus technologies provide the ultimate flexibility in control I/O and distributed intelligence. The AtlasPC platform embraces this trend while still providing on-board I/O for those signals that are not commercially or technically ready for field bus distribution.

Field bus standards supported:
- Profibus DP (12MBaud)—optional SmartCom communications module
- Ethernet TCP/IP Modbus—standard on Pentium CPU
- Check with Woodward for additional options—other common field bus protocols can be added through optional SmartCom communications modules.

Many field bus standards currently compete for market share in engine and turbine control. The AtlasPC platform can adapt to changing requirements.

Typical AtlasPC Configuration—Networked Control Strategy

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—Ethernet or Serial connection to Windows-based control variable viewing (see product spec 03202)
- Control Assistant—Ethernet connection to Windows-based viewing of high-speed data log captures and other useful utilities (see product spec 03201)
- Application Manager and Other Engineering Interface Tools—Ethernet access to the AtlasPC control for program loading, network configuration and support, and system diagnostics (refer to manual)
- Remote Access—Powerful and seamless remote connectivity is inherent in the Windows NT operating system of the AtlasPC system. Remote viewing, access and diagnostics are as close as a network or a modem.
- Human Machine Interface (HMI)—Standard commercial HMI programs interface through Ethernet or serial to provide operator access.
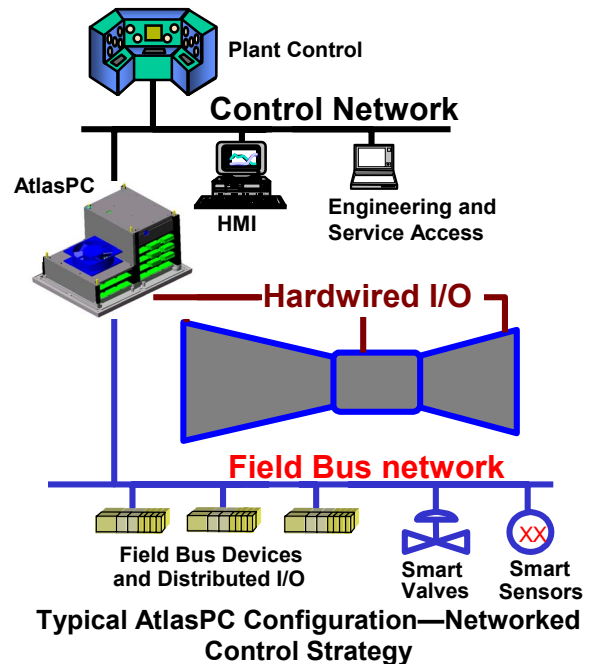
AtlasPC Control System Modules

- **Pentium CPU Board**
  - 266 MHz Pentium, 64MB RAM
  - On-board solid state hard drive
  - Hard Real Time NT operating system
  - Ethernet (communications, distributed I/O)
    - *10/100 Base T auto sensing and auto switching*
  - 2 Non-isolated Serial Ports (Service Interface and Remote Access Services)

- **SmartCom Profibus Communications Board**
  - 12 MBaud Profibus DP Master

- **AtlasI/O Analog Input/Output Board**
  - 2 MPU speed pickups
  - 4 RTD (100 or 200 ohm, 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

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

- **SmartCore Board**
  - 3 Isolated Serial Ports
    - *1 RS232*
    - *2 configurable RS232, RS422, or RS485*
  - 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)

- **PowerSense Board**
  - 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

Environmental Specifications

- **Skid Mount Packaging**
  - CE compliant—Low Voltage Directive, EMC Directive, ATEX Directive
  - European Class I, Zone 2, Group IIC when installed in an IP-54 minimum rated enclosure per DEMKO certification
  - UL Class I, Div 2, Groups A, B, C, D
  - Operating temperature: –20 to +70 °C (+60 °C w/ Profibus)
  - Storage temperature: –40 to +85 °C
  - Vibration: Lloyds RS ENV 2 (0.7 g, 15–150 Hz)
  - Shock: US MIL-STD-810C, 516.2-2 (30 g, 11 ms, 1/2 sine)
  - IP-56 Front Panel with optional *Display and Keypad (future)*
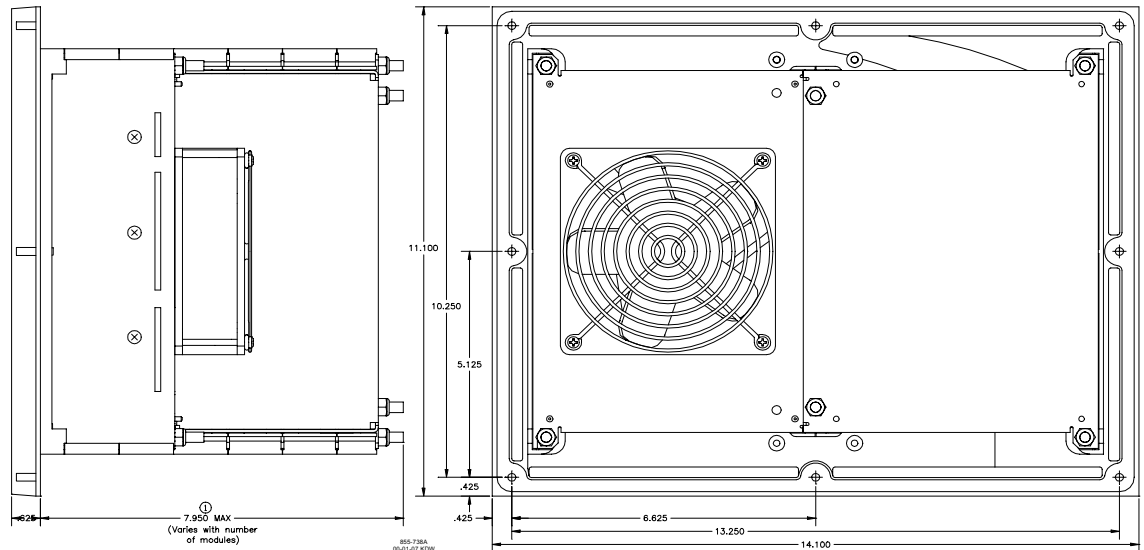
AtlasPC Control Outline Drawing

For more information contact:

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