Engine Control Systems for Industrial Engines

altronic

Altronic Engine Control Systems

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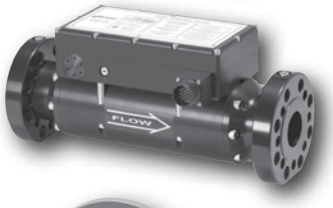

Insuring Performance and Compliance: Altronic Control Systems for Natural Gas-Fueled Engines

Each make and model of natural gas engine has its own unique set of starting and performance requirements. For well over twenty years, Altronic has met these individual needs with high-quality, easily-installed and understood control systems for small and large gas engines alike. Constant attention to product development and manufacturing quality prompt users around the world to turn to Altronic control products to meet their natural gas engine air/fuel ratio control, speed governing, and starting system requirements.

The pages that follow will give you a solid introduction to the range and specific capabilities of each member of the Altronic engine control product line. Additional details, including application, installation, and operating information associated with each system, can be found on the web at www.altronicinc.com. Your local authorized Altronic Distributor and Dealer, Regional Manager, and Altronic factory sales and service staff are also available to address your specific application questions

Certified System™
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NOTE: Most, but not all, Altronic digital instruments and controls in this catalog are CSA certified and compliant with the appropriate CE/ATEX regulations. Check each product listing for certification and hazardous area classification.

Air/Fuel Ratio Control Systems and Accessories

EPC-50 Air/fuel Ratio Control for Low-Horsepower Carbureted Natural Gas-Fueled Engines

The Altronic EPC-50 is an air/fuel ratio controller designed for use on low-horsepower, carbureted natural gas-fueled engines. It employs microprocessor technology, allowing for a high level of sophistication in control strategy, ease of configuration and diagnostic capability. The EPC-50 and associated small engine-specific control valves are designed for use on engines operating at or near a stoichiometric air/fuel ratio and is ideally suited for application with 3-way catalytic converters. While it is designed to be mounted in the engine/compressor control panel, a NEMA 3R housing (720004-1) is also available as an alternative mounting option.

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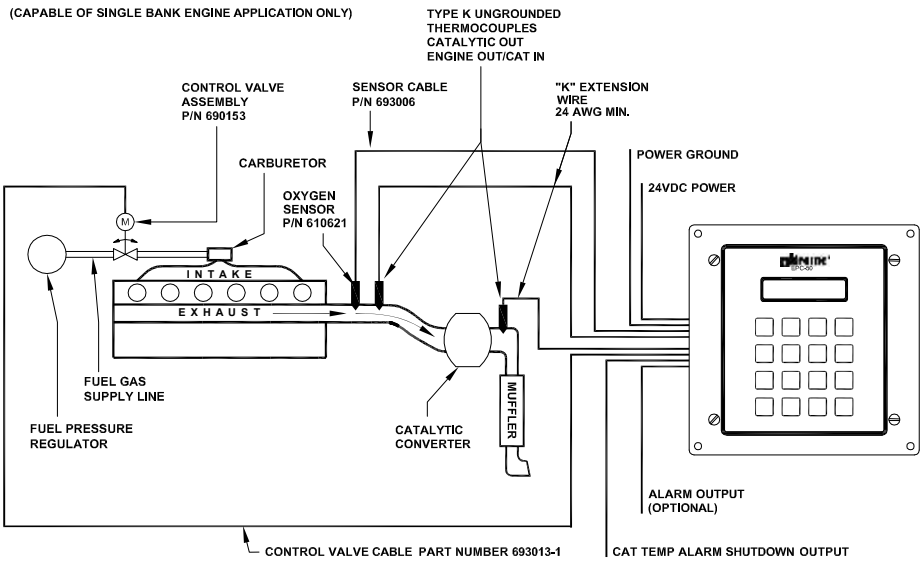
The single control output of the EPC-50 allows for its use on any engine application incorporating a single fuel gas regulator. An oxygen sensor is used in the exhaust stream to sense O_2 content, and a thermocouple input signals when proper exhaust temperature has been reached to allow for accurate sensor operation. A system fuel control valve installed in the fuel line to the carburetor is precisely adjusted by a stepper-motor under microprocessor control to maintain the correct O_2 content in the exhaust. The desired air/fuel ratio can be easily adjusted by changing the control target voltages through the sealed membrane keypad or through the use of a PC. The EPC-50 also incorporates a thermocouple input and a dedicated output for implementation of catalyst over-temperature protection. A second digital output is available for use as an alarm for diagnostics or uncontrolled operation.

The EPC-50 has an alphanumeric LCD display showing the target voltage, sensor voltage, operating temperature, stepper motor position and diagnostic information.

Power requirement is 24 (12–30) VDC, 1 amp. In remote areas, power can be provided by the Altronic 24VDC Alternator Power Package. Refer to Altronic Form ALT.

- Designed specifically for use on low-horsepower stoichiometric natural gas-fueled engines
- Accurate closed-loop control of air/fuel ratio for minimum engine emissions
- Precise full authority actuation using digitally-controlled valves for positive fuel control
- Modbus-based EPC terminal program and expanded I/O available to implement advanced control strategies
- Fully supports Modbus RTU communications with included PC monitoring software



PART NO.	CH.	MOUNTING	APPLICATIONS	VALVES
EPC-50	1	Panel Mount	Low horsepower, carbureted	690153/154 series 690220/225/230 series

Air/Fuel Ratio Control Systems and Accessories

EPC-110/120 Air/Fuel Ratio Control and Monitoring Systems for Carbureted, Stoichiometric Engines

The Altronic EPC-110 and the EPC-120 are air/fuel ratio controllers for use on carbureted gas engines. These controllers utilize microprocessor technology, allowing a high level of sophistication in control strategy, ease of programming and diagnostic capability. The EPC-110 is intended for stand-alone, off-engine, post- or wall-mounting. The EPC-120 is intended for off-engine, panel mounting. Both controllers are identical in operation. The EPC-110/120 is designed for use on engines operating at or near a stoichiometric air/fuel ratio (lambda .95 – 1.05) and is ideally suited for application with 3-way catalytic converters.

The control approach of the EPC-110/120 assures engine operation at the optimum lambda (exhaust oxygen) setpoint determined to be the point of maximum catalytic converter efficiency and minimum engine emissions. Once determined (through an analysis of the engine exhaust), it is entered into the EPC-110/120 as the control setpoint. Using a sensor in the exhaust stream to sense the O_2 content, the unit begins to adjust the flow of fuel to meet the proper exhaust oxygen setpoint(s) for minimum emissions. The full-authority fuel control valve(s), mounted in the fuel line between the carburetor and the final cut regulator, assures precise, repeatable control of the air/fuel ratio without resorting to the potentially dangerous strategy of adding fuel to the air intake of the engine.

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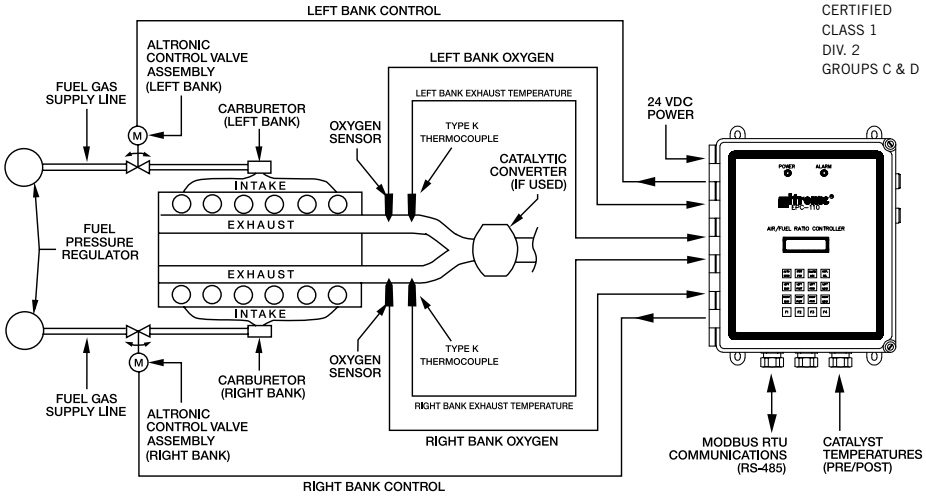

Monitoring and protecting the engine and catalyst from high temperature-related damage or out-of-compliance operation is a key function of the EPC-110/120 system. Critical temperatures are monitored against user-adjustable setpoints using type K thermocouples.

Setpoints are tied to one of two NC switch outputs for integration with a safety shutdown panel or supervisory control system. The Error Alarm Output is tripped for all setpoint violations associated with rich/lean control limits, oxygen sensor issues, and other values related to the control functionality. All catalyst temperature setpoint violations (pre-, post-, and differential) prompt the Catalyst Temperature Output to trip.

- Single and dual-channel models for control of in-line or V-type engines – single channel can be used on V-engines with one pressure regulator/carburetor
- Built-in engine and catalyst temperature monitoring/protection

PART NO.	CHANNELS	MOUNTING	APPLICATIONS	VALVES
EPC-110-1	1	Stand-alone	Stoichiometric, carbureted	690154 series 690220/225/230 series
EPC-110-2	2			
EPC-120-1	1	Panel Mount		
EPC-120-2	2			

Air/Fuel Ratio Control Systems and Accessories

EPC-100E Advanced Air/Fuel Ratio Control System for Carbureted, Stoichiometric Engines

The most full-featured of the EPC series, this highly-capable system is unique in its capacity for customization and precision control of the air/fuel ratio, particularly on engines with highly dynamic ambient and/or operational conditions. The EPC-100E combines a proven control approach with the ability to tailor both the lambda setpoint and responsiveness to any excursions in the monitored air/fuel ratio.

An effective, closed-loop control approach and simplicity of installation and setup have made it the control of choice worldwide. Recently, however, many users have found it necessary or helpful to apply new air/fuel ratio control capabilities as part of a larger effort to secure more consistent or even further reduced exhaust emission levels across a range of operating conditions.

The EPC-100E offers advanced, user-customizable control parameters for the dynamic adjustment of the target O_2 setpoints and controller gains, as well as a means of inhibiting automatic control on the basis of satisfying an external parameter such as load or a post-catalyst O_2 setpoint. This is accomplished through the use of a proprietary, high-level Windows™-based software package. For example, an EPC-100E can be dynamically adjusted versus load (typically derived via an input transducer monitoring air manifold pressure).

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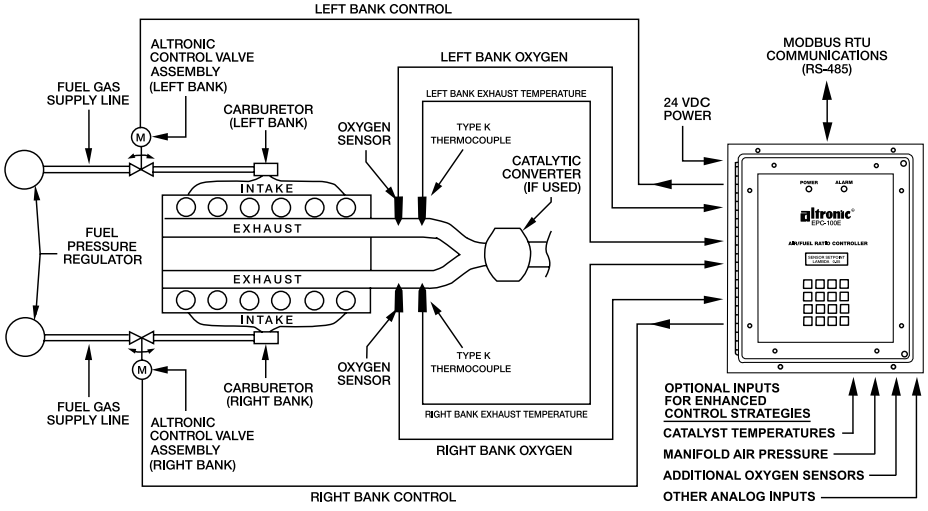
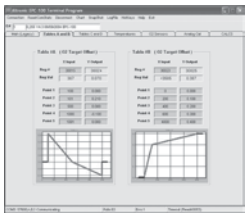
The user retains the simplicity and familiarity of the EPC-100 system if no enhanced setpoint or gain adjustment control is required, but can easily invoke such functionality if necessary. These enhanced features and capabilities are accessible only via the EPC-100E Terminal Program, their operation and configuration is essentially hidden from the user and resistant to tampering or unauthorized adjustment.

- Designed to optimize the performance of 3-way catalytic converters
- User-customizable control of target lambda setpoint(s) and controller gain adjustment, and access to additional alarm, shutdown, and emissions compliance diagnostics
- Ideal for applications exhibiting ambient, load, or other operational variations
- Universal model available for control of in-line or V-type, naturally-aspirated or turbocharged engines
- Full-authority fuel control eliminates hazardous direct gas admission into the air intake of the engine
- Uses inputs and outputs in EPC-100 units beginning with serial number 5713



PART NO.	CH.	MOUNTING	APPLICATIONS	VALVES
EPC-100E	2	Panel Mount	Stoichiometric, carbureted	690154 series 690220/225/230 series



The Altronic ModBus RTU-based EPC-100E terminal program enables users to monitor system performance and to implement customer control capabilities using the standard EPC-100E hardware set, including dynamic lambda setpoint adjustments (shown).

Air/Fuel Ratio Control Systems and Accessories

EPC-150 Lean-Burn Engine Air/Fuel Ratio Controller

The EPC-150 is designed for use on all lean-burn, carbureted, natural gas-fueled engines. Suitable applications include Caterpillar 3400 and 3500-series, Waukesha VHP-class, and most Cummins and Superior models. This innovative control offers reliable, precise, and positive air/fuel ratio control, with simple installation and operation. It also incorporates advanced operating features which address engine conditions specific to lean-burn operation.

The EPC-150 adjusts fuel delivery to meet and maintain a user-entered exhaust oxygen setpoint. The exhaust oxygen level is continuously monitored by a lean-burn oxygen sensor. During system setup, an exhaust gas analyzer determines the oxygen level at which engine-out emissions are at their lowest, and the corresponding setpoint is entered into the EPC-150 as the control setpoint. As load and other parameters change, the EPC-150 maintains the air/fuel ratio necessary to meet the desired exhaust oxygen level, assuring "in-compliance" engine performance.

A unique control protocol limits "lug" conditions, whereby a lightly loaded lean-burn engine becomes incapable of generating sufficient turbo boost to meet the speed setpoint established by the governor. This control approach — which monitors intake air pressure both before and after the throttle plate — enables the controller to automatically offset the oxygen setpoint for richer operation and ultimately increased turbo boost pressures. With the engine operating more smoothly and achieving the necessary RPM, automatic control at the desired oxygen setpoint is then restored. As with all other EPC-150 operating parameters, the point at which such an offset would be made, and its value, is fully adjustable from the keypad of the control unit or remotely using the integral RS-485 ModBus RTU communications system.

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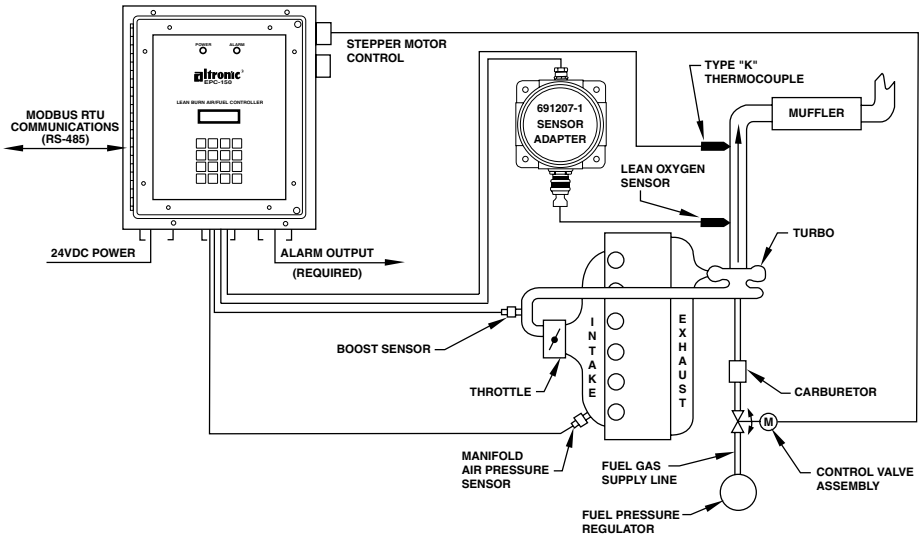
- Applicable to both single and dual-regulator lean-burn engine configurations
- Incorporates a durable, cost-effective lean-burn sensor for positive, closed-loop air/fuel ratio control
- Includes a series of innovative control capabilities, including an engine "lug" recovery protocol
- Integral, ModBus-RTU-based serial monitoring and control and Terminal Software



PART NO.	CH.	MOUNTING	APPLICATIONS	VALVES
EPC-150	2	Panel Mount	Lean-burn, carbureted	690154 series 690220/225/230 series

Air/Fuel Ratio Control Systems and Accessories

Actuating Control Valves (690-Series)

To operate in conjunction with its Air/Fuel Ratio Control Systems and other gas control applications, Altronic offers a complete family of actuating control valves. These rugged and reliable actuators incorporate sophisticated position control technology (digital linear actuator-based), and have become the fuel control standard in the oil, gas, and power generation industries for the precision control that they offer and the minimal maintenance and calibration that they require.

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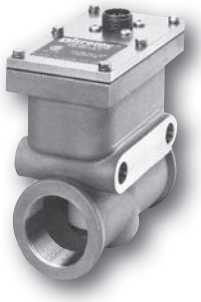
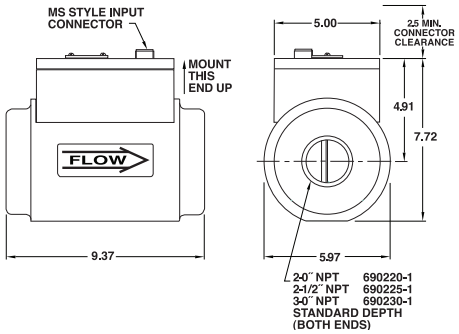
Altronic actuating control valves are available in both the piston style (silver body), and butterfly plate (black body) configurations. "Universal" in their design, they are suitable for use with all Altronic controllers on both in-line and V-type engines, and on both naturally-aspirated and turbocharged models. 1.5" NPT, 2.0" NPT., 2.5" NPT, and 3.0" NPT fuel line diameters can be directly accommodated without the need for additional adaptor fittings in the line.

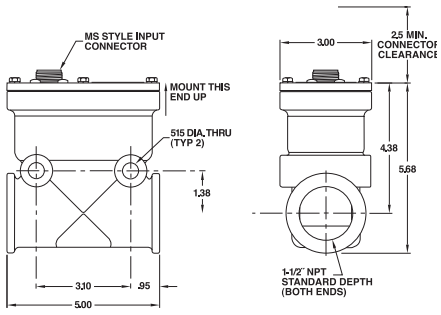


- "Universal" valve designs are suitable for use on virtually any carbureted natural gas engine
- Sophisticated digital linear actuator utilized in all valve models assures precise, repeatable control
- Field proven and oilfield-ready

Butterfly Style (6902XX-Series)



Piston Style (690154-Series)



Stepper Motor (Fuel Control Valve) Controller (SMC-Series)

The SMC-series Stepper Motor Controller is designed to give users of control systems having a standard analog output an effective and convenient means of integrating Altronic Actuating Control Valves. The unit is DIN-rail mounted and easily installed in the back of a control panel or other suitable enclosure.

A standard 4-20mA input control signal is used as the primary input to the SMC Controller. That input signal is converted such that, across the 4-20mA range of the input, the user achieves a fully linear 1700-step span to dynamically adjust the position of the control valve piston or butterfly. The SMC board drives a single Actuating Control Valve.

- Offers simple integration of the Altronic actuating valves into control systems with analog output
- Assures precise valve control

Air/Fuel Ratio Control Systems and Accessories

EPC-200C Fuel-Admitted Engine Performance Controller

Complete air/fuel ratio and ignition timing control for fuel-admitted gas engines is provided by the Altronic EPC-200 Engine Performance Controller. Replacing obsolete OEM and/or pneumatic controls, this flexible and fully-configurable system is an effective upgrade solution for operators of turbocharged integral compressor engines, as well as high-speed, fuel-admitted separable engines including many Superior and MEP models.

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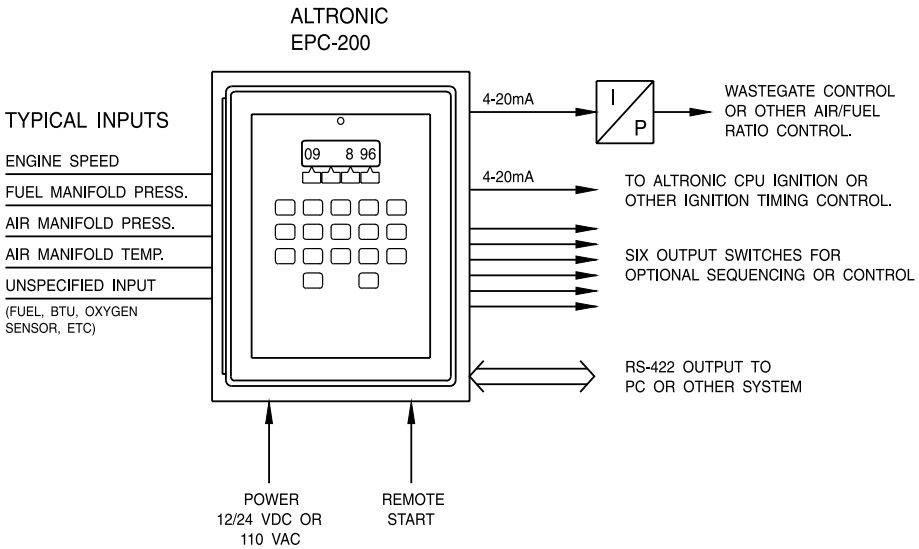
Monitored engine RPM plus up to four other analog inputs are used as control variables. In a typical application, fuel manifold pressure, air manifold pressure, and air manifold temperature are configured as the primary control inputs. The fourth (unspecified) input is often connected to a variety of devices including exhaust oxygen sensors, KW sensors, and calorimeters. Using operating data taken from the existing controls and determined during the commissioning process, these monitored values are used as inputs to optimize both the engine air/fuel ratio and the desired ignition timing across the range of ambient conditions, speeds, and engine loads. Control of these functions is accomplished by two independent 4-20mA signals: one for use with an Altronic CPU-series digital ignition system (timing control), the other to an I/P-based turbocharger by-pass for wastegate control (air/fuel). Six user-programmable solid-state relay outputs are also available to incorporate common sequencing functions such as purge, overcrank, crank disconnect, etc.

Available power options include 12 or 24VDC, as well as 110VAC input. Serial communications capabilities are standard in all EPC-200 system models. EPC-200 Engine Performance Controllers are often integrated with other Altronic instruments in an Altronic Controls-manufactured panel, providing complete engine/compressor protection and control.

- "Universal" controller suitable for use on turbocharged, fuel-admitted gas engines
- Improves engine performance and efficiency
- Fail-safe design features and fault annunciation
- Seven discrete outputs for sequence control



Speed Governing and Fuel Control Systems

AGV5 Smart Gas Control Valve

Designed for service as an actuation device for a supervisory speed governing or air/fuel ratio control system, the Altronic AGV5 is a single-stage, electronically-actuated, balanced poppet, fuel control valve. Due to its precision control, rugged design, and tolerance to fuel contaminants and corrosives, the AGV5 is used extensively on integral compressor applications and on other large fuel-admitted natural gas engines (such as Superior and MEP) as an upgrade over existing pneumatic fuel actuators.

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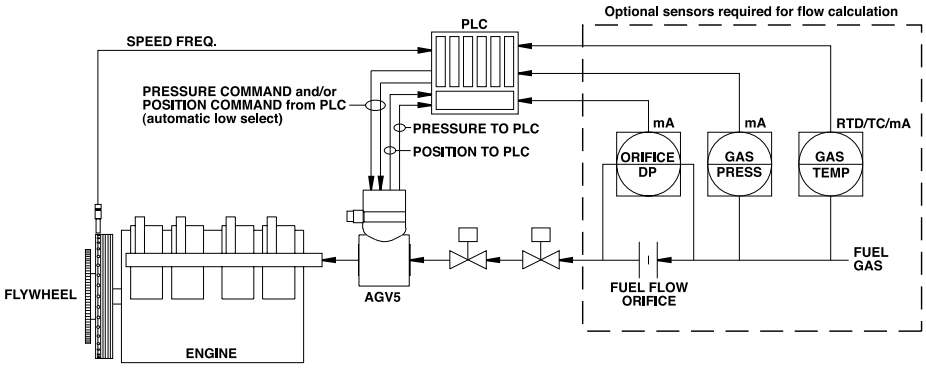
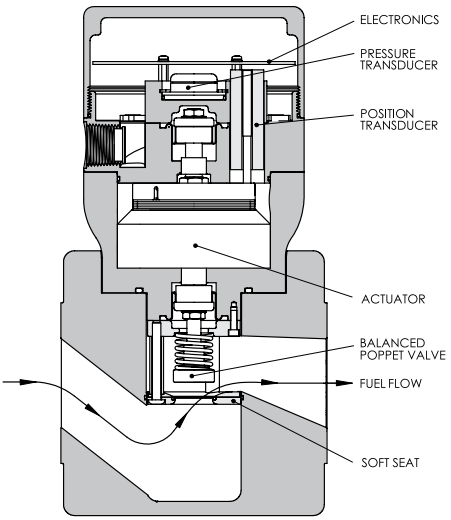
Control is derived from industry-standard 4-20mA output signals generated by the associated controller. For speed control applications, this would require that all governing logic, RPM and pressure setpoints, and timers be defined and resident within the controller itself, driving the AGV for fuel actuation.

(Note: If a full-authority, turnkey speed control capability is required, please see the description of the GOV10/50 Gas Engine Governing Systems on page 10). Two models of the AGV5 are available (standard and high-flow) to accommodate the fuel flow control needs of engines up to 10,000 horsepower.

The presence of both pressure and position control 4-20mA inputs (and corresponding 4-20mA feedback signals for each) makes it possible for the supervisory control system to control the gas manifold to a desired setpoint for startup, and then to switch to standard governing logic when the engine comes up to rated speed. The result of this unique approach is that the engine starts more consistently and reliably, and runs in a more stable fashion. Pairing the AGV5 with such a supervisory speed control also eliminates the need for maintenance-intensive and costly mechanical or bladder-style fuel valves and actuators, hydraulic governors, and all linkages associated with them.

- Eliminates mechanical fuel valve, actuator, and linkages
- Allows for improved starting and speed stability
- Regulates gas flow in response to an input signal or signals
- Feeds back valve position and fuel manifold pressure
- Fail safe design: spring-loaded closed in the event of power failure

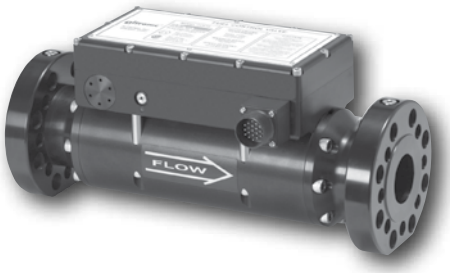




Speed Governing and Fuel Control Systems

GOV10/50 Gas Engine Governors

Taking an innovative, unique approach to fuel-admitted gas engine speed control, the Altronic GOV10/50 Systems bring



both the fuel control valve and a sophisticated electronic governor together into a single, integrated unit. Designed for use on both integral compressors such as Cooper-Bessemer, Clark, Ingersoll-Rand, and Worthington, as well as high-speed separables such as Superior and MEP, these robust, precision-control devices effectively eliminate troublesome hydraulic governors, actuators, and linkages. The result is significantly improved starting performance and speed stability across the engine load range.

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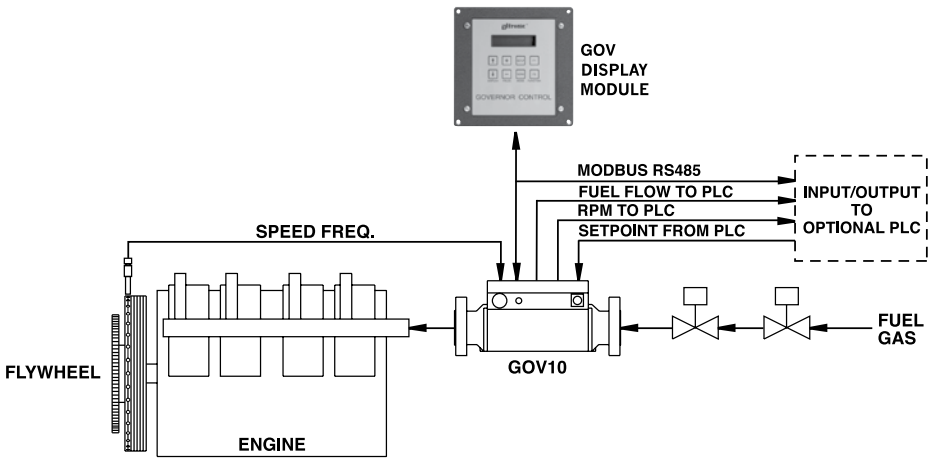
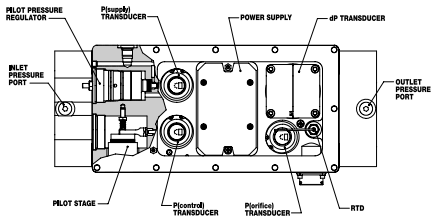
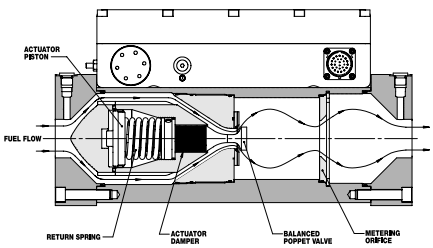
The GOV systems are mounted directly in the engine fuel line, and very precisely control gas flow to the engine by changing the position of an internal poppet valve. Using fuel gas pressure as the "muscle" for the actuation force, this poppet valve is moved in the open or closed direction to meter the delivery of the fuel and to regulate and govern the speed of the engine under all loads. On-board pressure, differential pressure, and temperature monitoring sensors, along with engine RPM and an optional fuel flow measurement capability allow for accurate control of engine speed. A sophisticated, user-tunable speed governing algorithim is resident within the GOV enabling the system to properly meet the individual startup, loading, and run requirements of each engine. Since many engines are highly sensitive to flooding at startup, the GOV10 can easily be configured to control to a specified pressure curve during the start and warm-up cycles, and then to switch to an RPM setpoint-based control strategy for run conditions.

Two GOV models are available—the GOV10 is used on engines up to approximately 3,500 hp, and the GOV50 applies to engines ranging from 3,500 to 10,000 hp. Configuration of the GOV can be accomplished through the system Display Module or via the ModBus-RTU-based GOV10 Terminal Software included with each unit. That same RS-485 serial link can also be used for direct interaction between the GOV and a supervisory device for remote system monitoring and control.

- Integrates governing electronics and a state-of-the-art fuel control valve
- Eliminates separate actuators and linkages
- Improves engine starting and speed stability
- Fail-safe design inhibits the flow of fuel to the engine on the loss of power
- Display Module and Terminal Software assure convenient access to the current run data and configuration values of the GOV system







Engine Starting Systems

SaveAir™ Electronic Air Start System

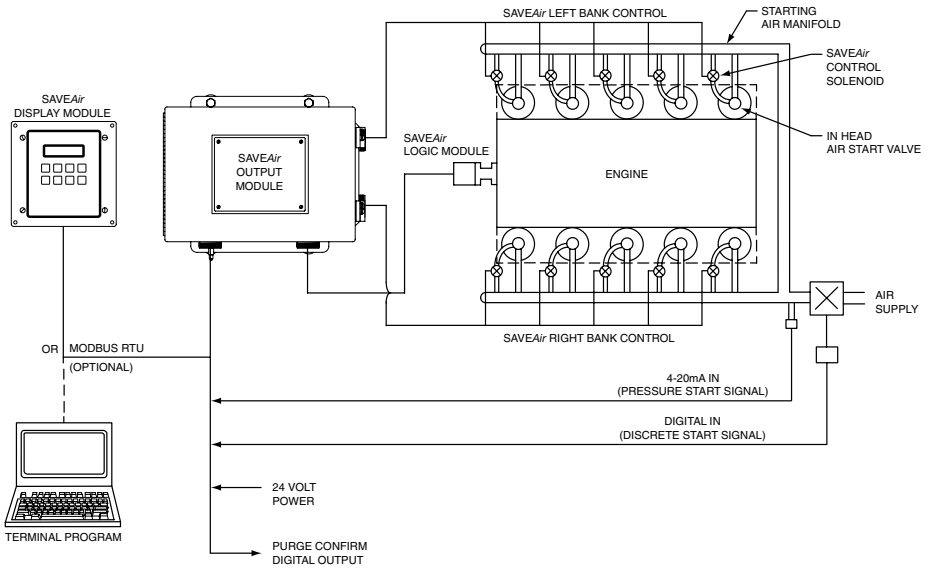
Built to replace troublesome, maintenance-intensive OEM or pneumatic air start distribution systems, the Exline-

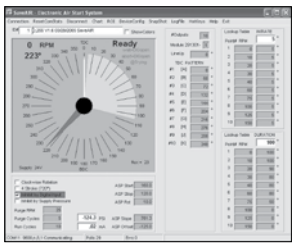
Altronic SaveAir™ Electronic Air Start System brings solid-state electronic control to the starting function of air-in-head starter equipped, integral compressor engines. Eliminating the mechanical air-start related components, the state-of-the-art SaveAir™ system introduces significant operational advantages, including a substantial reduction in the required starting air (up to 70%) and the elimination of starting "dead spots".

The heart of the SaveAir™ system is an innovative, engine-mounted position sensing device used to determine the precise angular location of the crankshaft, even while the engine is at rest. With accurate radial position data in hand, the SaveAir™ system electronically actuates air-starting solenoid valves, which precisely control both the turn-on time of the air-in-head valves as well as the duration of the individual air admission events during startup. These unique capabilities enable the SaveAir™ system to deliver starting air to those cylinders which are most appropriate given the angular position of the crankshaft — virtually eliminating engine starting "dead spots" — and to drastically reduce the amount of starting air required. More reliable remote starting, improved operator safety (no mechanical barring), reduced air consumption, and more efficient compressor station operation are just a few of the benefits of SaveAir™ operation.

All SaveAir™ system electronics are "universal" in their design and common to all applications. Engine-specific Logic/Distribution Module flanges and/or adaptors ensure a simple installation on virtually any suitable engine. Configuration and monitoring of the SaveAir™ system can be accomplished through the Display Module or via the PC-based Terminal Program supplied with every unit.

- Reduces starting air consumption by as much as 70% per start
- Provides more reliable remote starts and eliminates starting "dead spots"
- Replaces failure-prone mechanical air start components with solid-state electronics
- Less costly and complex than ring gear-based starting conversion systems
- "Universal" system hardware set





PC-based Terminal Program

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The HOERBIGER Group

HOERBIGER Compression Technology is a business unit of HOERBIGER Holding AG, Zug / Switzerland. HOERBIGER is active throughout the world as a leading player in the fields of compression technology, automation technology and drive technology. Its 6,400 employees achieve sales of around 1 billion Euro. The focal points of its business activities include key components and services for compressors, gas engines and turbomachines, hydraulic systems and piezo technology for vehicles and machine tools, as well as components and systems for shift and clutch operations in vehicle drive trains of all kinds. Through innovations in attractive technological niche markets, the HOERBIGER Group sets standards and delivers cutting-edge solutions for the benefit of its customers.

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