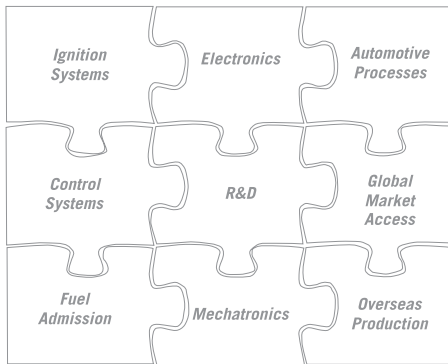




Engine Solutions



Setting the standard for combustion control of gas-fueled industrial engines with products and solutions that contribute to a healthier environment, enhanced reliability and improved performance



HOERBIGER Engine Solutions represents the accumulated knowledge and experience of many of the world's leading experts in combustion technology drawn from the automotive and industrial engine industries.

These men and women—industrial designers, technicians, electrical, mechanical, hardware, software, process, and production engineers—are visionaries who truly understand the needs of their customers and take pride in developing and producing the highest quality products possible to meet those needs.

HOERBIGER contributes a wealth of expertise in automotive processes, including fuel admission technology and mechatronics—combining electronic and mechanical components—coupled with an unrivaled research and development program.

HOERBIGER's family of companies—160 facilities in 50 countries—provides both global market access and overseas production capability.

HOERBIGER Engine Solutions emerged with the addition of Altronic, LLC to the HOERBIGER Group.

Altronic has long been regarded as the world's leading manufacturer of ignition and control systems for industrial engines. These products represent the industry standard for quality. All are designed to improve engine performance and enhance reliability. Many also improve operating efficiency, helping to reduce emissions which contributes to a healthier environment—a concept we call GREENABILITY.

Combining HOERBIGER's outstanding position in valve technology with Altronic's unmatched capabilities in combustion control products to form HOERBIGER Engine Solutions has resulted in a reliable partner for the gas engine industry—a partner that is secure, stable, and predictable.





One-stop shopping for industrial gas engine control products and solutions

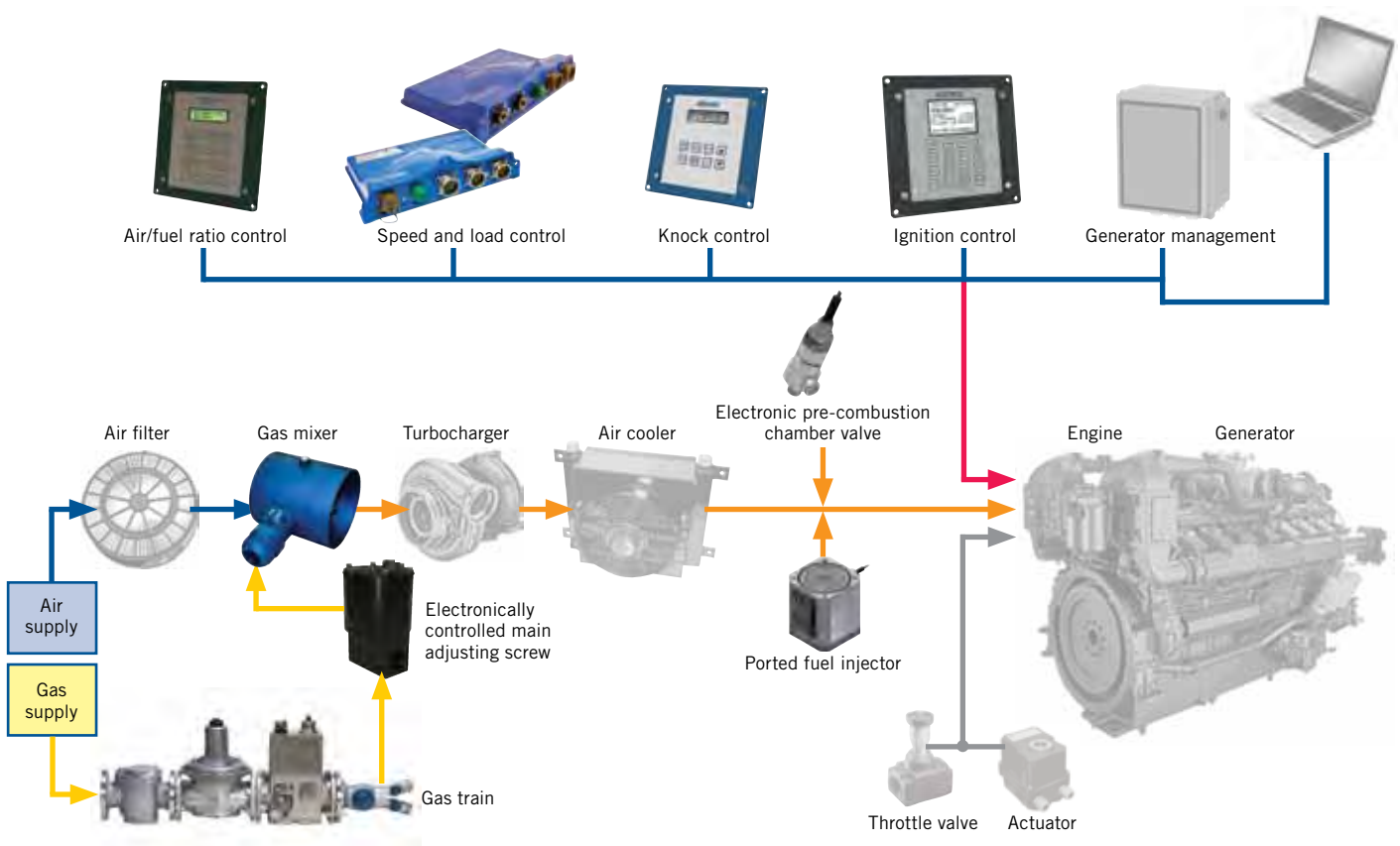
HOERBIGER Engine Solutions offers the finest, most reliable ignition and control products available anywhere in the world.

Altronic ignition systems run the gamut from solid-state workhorses that have been powering tens of thousands of engines in every corner of the globe for decades, to capacitor discharge ignitions and state-of-the-art crankshaft-referenced digital ignition systems.

Typical digital instruments and controls available include Detonation Sensing Monitors to help prevent catastrophic engine failures before they can occur; Air/Fuel Ratio Controls that govern the flow of fuel to the engine to maintain the target oxygen level during engine operation; Solenoid Driver Modules which control the fuel injection solenoid valves for speed control; and Advanced Engine

Controls which provide a full complement of features—all focused on combustion control.

HOERBIGER Engine Solutions will continue to refine these products and will work diligently to provide new products and solutions for your industrial engine applications.



Now air/fuel ratio, fuel admission, ignition, and knock control are available from a single source. Make HOERBIGER Engine Solutions your partner for advanced combustion technology of gas-fueled industrial engines.

Great products come from great ideas and great ideas come from understanding the customer

HOERBIGER Engine Solutions absolutely understands the customer's needs, the industry, the applications and the technologies involved. HOERBIGER Engine Solutions benefits from established research



programs with experience in automotive processes as well as industrial engine ignition and control technologies.

Transferring relevant technology, experience and knowledge gained through extensive automotive research helps HOERBIGER Engine Solutions develop products for advanced internal combustion engines.

Combustion monitoring and control has always been a key development area, and decades of accumulated experience has produced both cutting edge knowledge in certain specific technologies as well as broader and valuable perspectives on embedded systems and software for engine management.

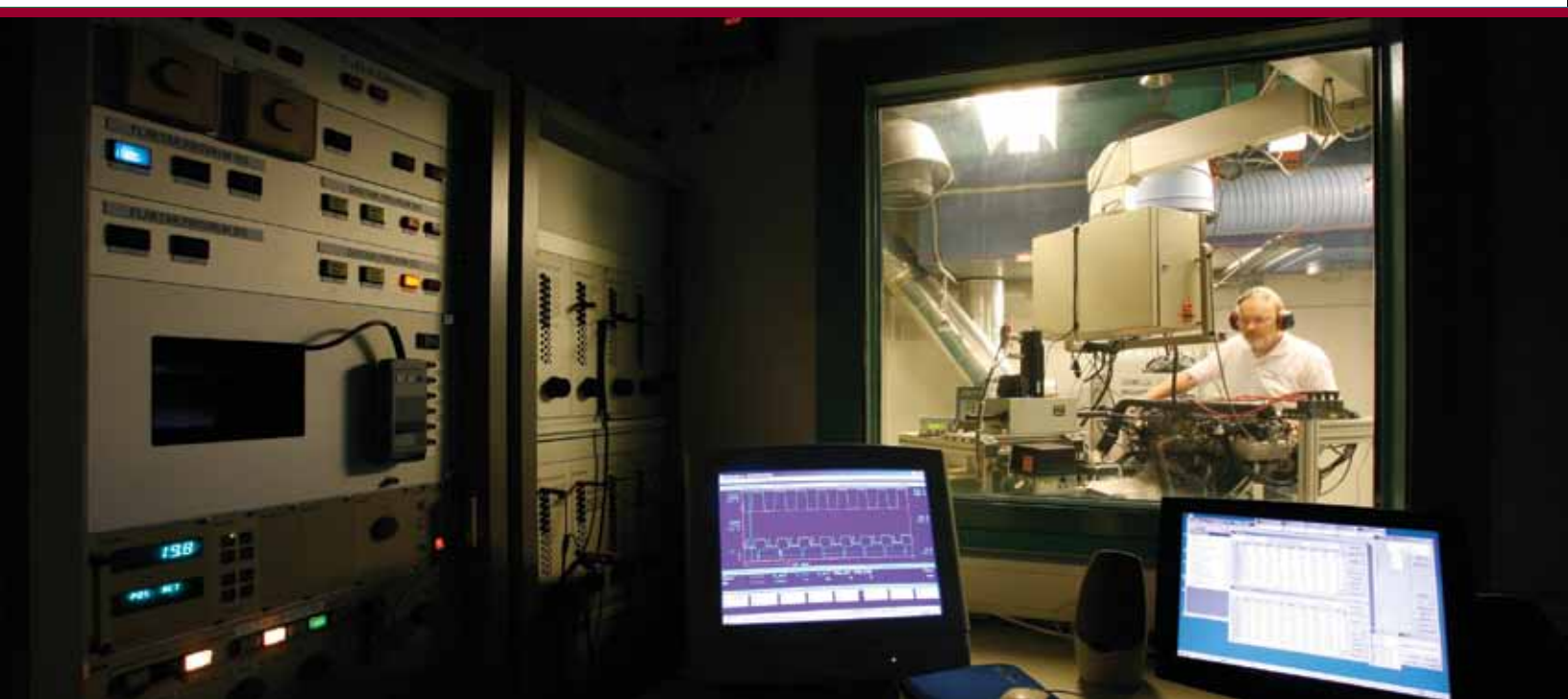
State-of-the-art development processes and tools are used to ensure high quality products. Additionally, HOERBIGER Engine Solutions maintains excellent relationships with strong university networks to enhance and support research initiatives.

Research and development areas include:

- Systems engineering
- Electronic hardware design
- Embedded software design
- Quality assurance, including system testing, verification and validation
- Project and product management
- Product and systems supply
- Engine control requirements
- Sensor technologies
- Signal processing, modeling and development of various control algorithms
- Fluid technology
- Thermo and gas dynamics
- Tribology
- Electronics
- Materials and metal forming technology

Engineering Services

HOERBIGER Engine Solutions offers its development capabilities to customers as well. Whether contracted development work or the development of proprietary OEM products, HOERBIGER Engine Solutions has a long record of successfully providing engineering services.





HOERBIGER Engine Solutions harnesses the power and value of focused research and development to create the products you need.

HOERBIGER – the Valve Authority



*ELECTRONIC PRE-COMBUSTION
CHAMBER VALVE (ePCC)*



PORTED FUEL INJECTOR (PFI)

In 1895, Hanns Hörbiger devised the steel-plate compressor valve, a breakthrough invention that enabled technical progress in important industrial sectors such as steel making, mining, refining and chemistry. Subsequent generations of HOERBIGER engineers have perfected the compressor valve, making it the industry standard for reliability and performance. Advances in material science, fluid dynamics and engineering mechanics have been incorporated into HOERBIGER's valve designs; continued innovation that provides significant benefits for compressor manufacturers and end users. When it comes to demanding applications—high pressure, high speed, corrosive or contaminated gases—there is no alternative to HOERBIGER.

Employing an accumulated wealth of manufacturing knowledge has helped HOERBIGER to succeed in other product areas such as pneumatic and hydraulic valve design, solenoid valves, piezo valves and control valves for screw compressors. In turn, the experience gathered in these widespread applications has paved the way for HOERBIGER'S entry into the solenoid-actuated fuel valve market. In 2000, HOERBIGER launched Hyperfuel Valve, the first fully-electric fuel valve for the direct injection of gas into large-bore gas engines. This high-pressure fuel valve en-

abled better fuel mixing and more precise fuel metering, resulting in lower emissions and better fuel efficiency. HOERBIGER is a pioneer in the field of hydrogen-fueled internal combustion engines, contributing ported fuel injection technology for BMW's clean efficiency vehicle—the world's first commercially marketed, hydrogen-fueled automobile. As part of a direct-injected hydrogen engine, HOERBIGER fuel valves helped to establish a record in fuel efficiency for SI engines.

HOERBIGER also developed the first checkvalve-less electronic pre-chamber valve for large bore engines, thus enhancing reliability and enabling ultra-stable lean combustion. HOERBIGER's engineers continuously strive to develop solenoid-operated fuel valves to serve the most demanding applications. They have pioneered double-acting solenoid valves with extremely short response time and even shorter duration—matching the dynamic response of piezostack-operated fuel injectors—while offering much larger flow area. HOERBIGER's new series of ported fuel valves are unrivaled in terms of compactness, suitability for ultra-dry gases, and service life. These valves are designed to work at higher differential pressures than any other comparable valves, but without pressure balance.





Altronic – the Ignition Authority

Altronic LLC is the world leader in the production of industrial ignition systems, engine controls and digital instruments.

The lead plant for HOERBIGER Engine Solutions, Altronic produces ignition systems for spark-ignited, natural gas engines, digital instruments and controls for heavy duty rotating equipment, and custom control panels for the oil and gas industry. Ignition system production began in 1966 with the Altronic I for one-cylinder oil pumpjack engines. The ignition line was later extended to four variations covering all stationary engines from 10 to 10,000 horsepower.

The Altronic digital instrument line began in the late 1970's with the industry's first digital annunciator, which replaced up to 32 electromechanical relays as indicators of alarms on gas compressors. This line now includes tachometers, hourmeters, pyrometers, and microprocessor-based instruments for monitoring pressures, temperatures, speed, vibration, and ignition timing.

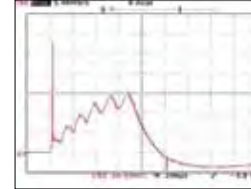
In the mid-1980's, Altronic introduced ignition systems based on digital circuits. These provided greater timing accuracy, the ability to change ignition timing electronically, and useful diagnostic informa-

tion for the engine operator. Today, Altronic digital ignition systems are used by most major OEM gas engine manufacturers.

Altronic is pioneering the next leap in technology for the stationary industrial engine market with the Directed Energy Ignition System (DEIS). The DEIS allows complete control over the spark characteristics including duration and energy, and provides the ability to control the secondary current profile. As a result, the secondary can be optimized to the fuel and mixture quality, combustion chamber design, load profile, etc. There is truly nothing else like it available anywhere, further demonstrating that Altronic is the leader in design innovation.

Altronic also produces a variety of ignition accessory items including FLASHGUARD® industrial spark plugs and spark plug leads, and the EZRail® Modular Ignition Rail System.

Since 2002, Altronic has manufactured the patented GTI Bi-Fuel® System which converts a standard diesel engine to operate on up to 70% natural gas or bio-gas, thereby reducing operating costs, extending run-time on stored diesel fuel, and reducing diesel emissions.



THESE SAMPLE WAVEFORMS ILLUSTRATE THE TYPE OF SPARK CONTROL POSSIBLE USING THE DIRECTED ENERGY IGNITION SYSTEM



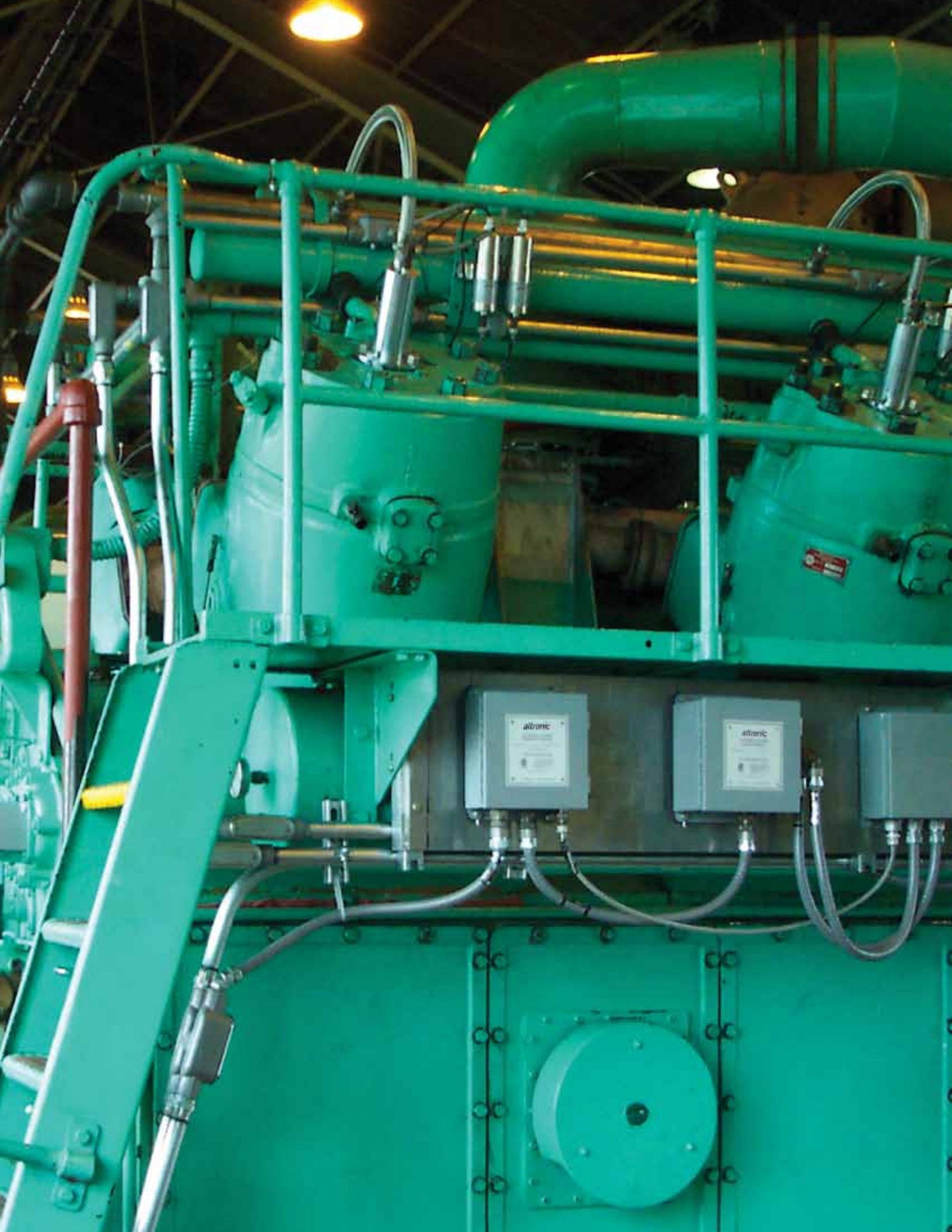
SOLID-STATE IGNITION



CAPACITOR-DISCHARGE IGNITION



DIGITAL ANNUNCIATOR



It All Starts Here...

Industrial gas-fired engines are mechanical marvels that require robust ignition systems to breathe life into them and keep them firing at peak efficiency. Altronic manufactures a family of ignition systems designed to meet the requirements of virtually any engine. More of these systems are in the field today than all other brands combined, a testament to their quality and reliability.

Solid-state ignition systems operate via a self-contained alternator that charges an energy storage capacitor. Magnetically-triggered pick-up coils provide timing pulses that discharge the capacitor in timed sequence, routing low-tension discharges to the ignition coil. Electronics are mounted on easy-to-replace plug-in modules. Drive couplings are furnished in synthetic elastomer materials for low wear and long life.



Disc-triggered digital ignition systems employ a cylinder position sensing design, typically using a single pickup and one trigger event per cylinder, which may be derived from an Altronic timing disc or holes/protrusions in the engine flywheel or camshaft gear. The pickup and timing disc provide accurate timing reference signals to the ignition unit, which calculates the correct ignition timing point. These innovative and reliable systems can be applied to a variety of engines, including heavy-duty vehicular applications as well as engines incorporating lean-burn technology.



Crankshaft-referenced ignition systems use a continuous crankshaft-sensing design. A magnetic pickup inputs signals from the engine ring-gear or holes drilled in the flywheel; a second pickup senses a revolution/reset event giving precise information on the location of the crankshaft. On 4-cycle engines, a reference signal at engine camshaft speed is used to determine the compression cycle. A replaceable memory chip, programmed with the engine's application data, operates with the CPU's digital circuitry to output precise firing pulses to the ignition coils. Altronic CPU systems eliminate mechanical wearing parts — gears, chains, couplings, etc.



...and Continues Here

Air/Fuel Ratio Controls are applicable to most carbureted natural gas-fueled engines, including stoichiometric applications using a catalytic converter as well as carbureted, lean-burn engines.

While stoichiometric and lean-burn engines require fundamentally different oxygen sensing technologies, all Altronic AFR systems operate on the basis of closed-loop control to a setpoint utilizing data from an exhaust-mounted oxygen sensor as feedback to precisely control the flow of fuel necessary to maintain the target oxygen level for optimal control of emissions.



Detonation Sensing Monitors are electronic instruments designed for use on natural gas-fueled engines to detect detonation and misfire and avoid consequential engine damage. Using industry-standard, low-cost, piezoelectric vibration sensors, these systems can be configured to activate an external unloader to reduce engine load, or (when used in conjunction with a digital ignition system) to automatically retard the ignition timing. In the event that an ignition timing adjustment also proves to be ineffective in eliminating engine detonation, a second output switch acts as a final safety measure to shut down the engine.





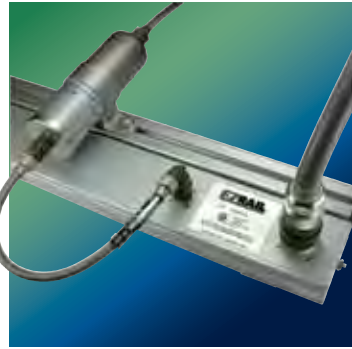
Solenoid Driver Module controls up to 20 fuel injection solenoids for large bore stationary engines. All cylinders can be individually controlled with regard to both fuel quantity and injection timing.



Advanced Engine Control provides advanced engine control features such as model predictive control, model based air/fuel ratio control or others. Control schemes are developed using state-of-the-art modeling tools and are autocoded into this hardened, engine mountable unit.



IGNITION COILS



MODULAR COIL MOUNTING SYSTEM



FLASHGUARD® SPARK PLUG



DIGITAL ANNUNCIATOR



SAFETY SHUTDOWN AND CONTROL



DIGITAL BAR-GRAPH SETPOINT GAUGE

altronic
HOERBIGER Engine Solutions



TOUCH SCREEN DATA HUB



COMPRESSOR CONTROL SYSTEM



GAS ENGINE GOVERNOR



GAS CONTROL VALVE



ELECTRONIC AIR START SYSTEM

HOERBIGER Engine Solutions products proudly bear the Altronic logo

This is a sign of assurance that you are receiving the highest quality, most reliable components possible.

Altronic Ignition Accessories are specifically engineered and constructed for trouble-free service on demanding 24/7 oilfield and power generation-based engines.

Altronic Coils are produced in the world's most advanced facility dedicated solely to industrial engine ignition coils. Unmatched in their quality, Altronic coils are often imitated, but never duplicated.

EZRail® Modular Ignition Rail Systems are factory-built, tested, and certified assemblies designed to eliminate field wiring and troubleshooting.

FLASHGUARD® Secondary Leads are rebuildable by the user, insuring a maximum return on investment and optimum performance.

FLASHGUARD® Spark Plugs are engineered and manufactured specifically for use in stationary gas engines, providing maximum flashover resistance, reduced RFI and improved service life.

Digital Annunciator Safety Shutdown System—pioneered and patented by Altronic—replaced a number of outdated electro-mechanical relays with one small, electronic unit operating with non-incen-

diary circuits. Its high reliability, moderate cost, and ease of use have made it the standard for remote field compressors. Current models include advanced features such as complete application configurability, comprehensive communications, and a simple means of integration into remote monitoring systems.

The complete line of Altronic digital monitoring devices includes single and multi-point temperature gauges and scanners, pyrometers, pressure gauges and monitors, tachometers, overspeed, and hourmeters. All are designed for critical service applications and suitable for use in environmentally harsh or hazardous areas.

MIDAS (Monitored Information Devices And Systems) Unlike a traditional PLC-based system, the MIDAS touch screen offers a user-configurable, graphical data presentation capability while preserving the system configuration and access made possible via the displays and keypads of each individual device within the panel.

Exacta 21 Compressor Controller is an “all-in-one” pre-programmed, dedicated controller for gas compressors and associated site equipment. It uses the MIDAS touch screen as its sole visible interface, but the Exacta 21 display and keypad are securely mounted and easily accessible inside the panel. Exacta 21 requires no knowledge of ladder logic or other

programming languages and performs all standard compressor control functions, as well as monitoring, shutdown, alarm, and annunciation functions.

GOV Series Electronic Governors with Integrated Fuel Valve fit a wide range of both integral and separable types of fuel injected engines. They completely eliminate troublesome hydraulic governors, actuators, and linkages, and significantly improve starting performance and speed stability.

AGV5 Smart Gas Control Valve is a single-stage, electronically-actuated, balanced poppet fuel valve designed to act as an actuation device for a supervisory speed control system. The AGV5 can also be used as an air/fuel ratio control valve or a variable pressure regulator in a variety of applications.

SaveAir™ Electronic Air Start System Eliminating virtually all of the mechanical air-start related components, the Exline-Altronic solid-state SaveAir™ system brings solid-state electronic control to the starting function on integral compressor engines equipped with air-in-head starters. It reduces the required starting air up to 70% and eliminates starting “dead spots”.



HOERBIGER Engine Solutions at a glance

Areas of expertise:

- Ignition systems
- Control systems
- Fuel admission
- Electronics
- Research and development
- Mechatronics
- Automotive processes
- Global market access
- Overseas production

OEM Products:

- Speed controls (SDM)
- Load controls (AEC)
- ePCC valves
- PFI Valves
- Engineering services

Products:

- Solid-state ignition systems
- Disc-triggered digital ignition systems
- Crankshaft referenced ignition systems
- Air/fuel ratio (AFR) controllers
- Detonation sensing monitors
- Ignition coils
- Modular ignition rail systems
- Secondary leads
- Industrial spark plugs
- Digital annunciators
- Temperature gauges
- Temperature scanners
- Pyrometers
- Pressure gauges
- Pressure monitors
- Tachometers
- Overspeed switches
- Hourmeters
- Touch screen data hub
- Compressor controller
- Electronic governors
- Gas control valves
- Bi-Fuel® systems



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altronic

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