

**EControls**<sup>®</sup>

by **INNOVATION** CONTROLS

**ENGINE CONTROLS AND FUEL SYSTEMS**



## WHO WE ARE

Since 1994, EControls has been a leader in the design, engineering and manufacturing of complete engine control solutions supplied to original equipment engine manufacturers. Our customer base includes some of the world's largest and most prestigious OEMs. They utilize our systems in the commercial vehicle, forklift, power generation and off-highway markets for their spark-ignited natural gas, LPG, gasoline and compression ignition engines. We work with our customers to provide proven products, cutting-edge technology and superior engine control solutions.

***When it comes to engine solutions and integration – trust our experts.***

### We Are Innovators.

By partnering with our customers, we understand their application needs and provide solutions that are finely tuned integrated systems. The integrated approach to equipment and engine management provides customers with advanced functionality, optimized performance and reliability.

### We Are Customer Driven.

Our solutions-based approach allows us to be your single source for all your engine and application control needs. We work directly with our customers to identify the exact application requirements and develop a complete system that is tailored for their needs. No more spec'ing out parts – let us do the work for you.

### We Are Eco-friendly.

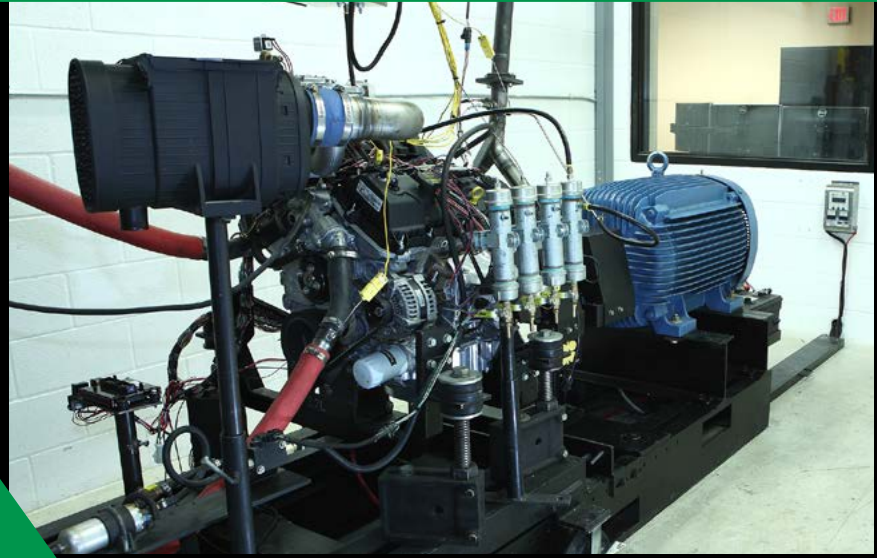
Emission regulations vary across all markets we serve, and these standards grow increasingly more stringent. EControls has invested to support these requirements allowing our customers to satisfy emission rules while becoming more efficient. Our spark-ignited engine control systems enable significant emission reductions, empowering our customers to meet and exceed any global regulation with the lowest total cost while maximizing conservation of the environment.

### We Are Global.

We are where our customers are. In North America, operations are centrally located in San Antonio, Texas, with additional offices in Tulsa, Oklahoma, and Rosenberg, Texas. We service the Asian market through our operations in Hangzhou, China, and Europe through the United Kingdom. Additional international sales offices are located in India, South Korea and Latin America. Customer support is achieved through our extensive distributor and dealer networks available throughout the world.



World-class engine calibration facilities allow us to calibrate to Euro VI and USA EPA 2010 and Large Spark Ignition emission regulations.



Extensive component and on-engine dynamometer testing ensures products function properly and provide long-lasting reliability.



State-of-the-art manufacturing capabilities allow us to provide world-class quality products and quickly customize for specific customer requirements.



## Base Engine Consultation and Design

Our breadth of knowledge allows us to offer base engine development and design services for combustion chambers, ignition systems, cam shafts, turbocharger matching, intake and exhaust manifolds, EGR sub-systems and catalysts. We take pride in our ability to work with engine manufacturers to implement design modifications to a base diesel or gasoline engine allowing them to operate on natural gas, LPG and gasoline.

## Engine Calibration

Our dynamometer facilities are world class. With these facilities, our technicians and engineers can quickly install our engine control system, instrument the engine, complete the engine calibration and perform the required emission testing. The value to our customer is speed to market with an engine that performs optimally in regard to emissions, power and efficiency.

## Engine Control Systems

Our engine control systems have been designed, tested and proven countless times in the field across a multitude of applications around the world. We are the industry leaders in the emission-regulated markets. Our continuous flow fuel control valves along with our model-based engine control modules allow our customers to reduce engine-out emissions, improve fuel economy and eliminate any concerns regarding contaminated or poor quality fuel.

## Quality and Technical Support

EControls has implemented a Global Operating System focused around Lean Six Sigma to identify and remove variables in our manufacturing and business processes. By pinpointing areas of improvement, we are able to provide our customers with faster delivery time and higher quality products. To better serve our customers, we also offer 24-hour customer service support and an in-house technical service department to answer all of your questions.

# Commercial Vehicle/Heavy-Duty On-Road Systems



Continuous Flow Valve (CFV)

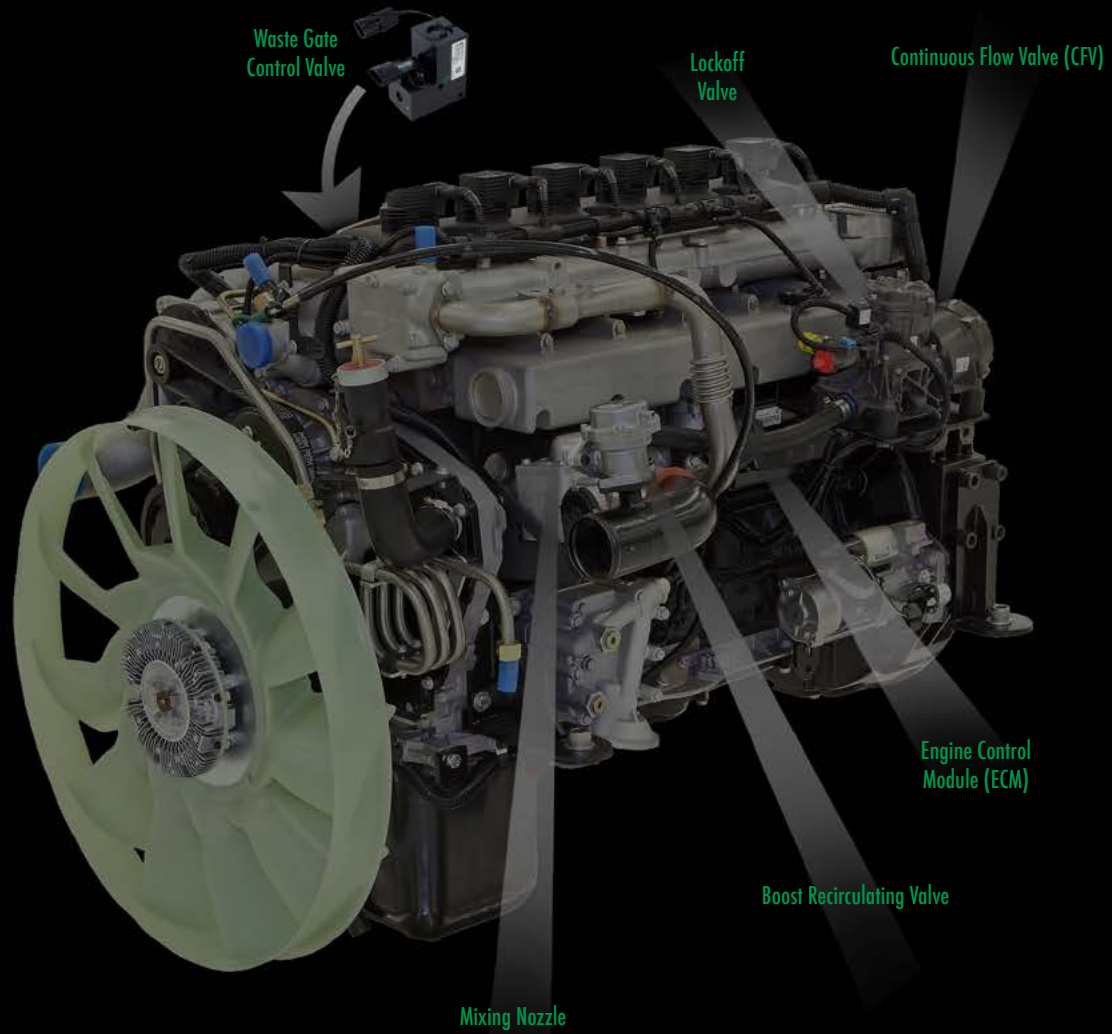


Engine Control Module (ECM)



Lockoff Valve

# Commercial Vehicle/Heavy-Duty On-Road Systems



Waste Gate Control Valve



Mixing Nozzle



Boost Recirculating Valve



Sensors

# Industrial Mobile Equipment Systems



Spark-ignited Engine Control Module (ECM)



Diesel Engine Control Module (ECM)



Mixer



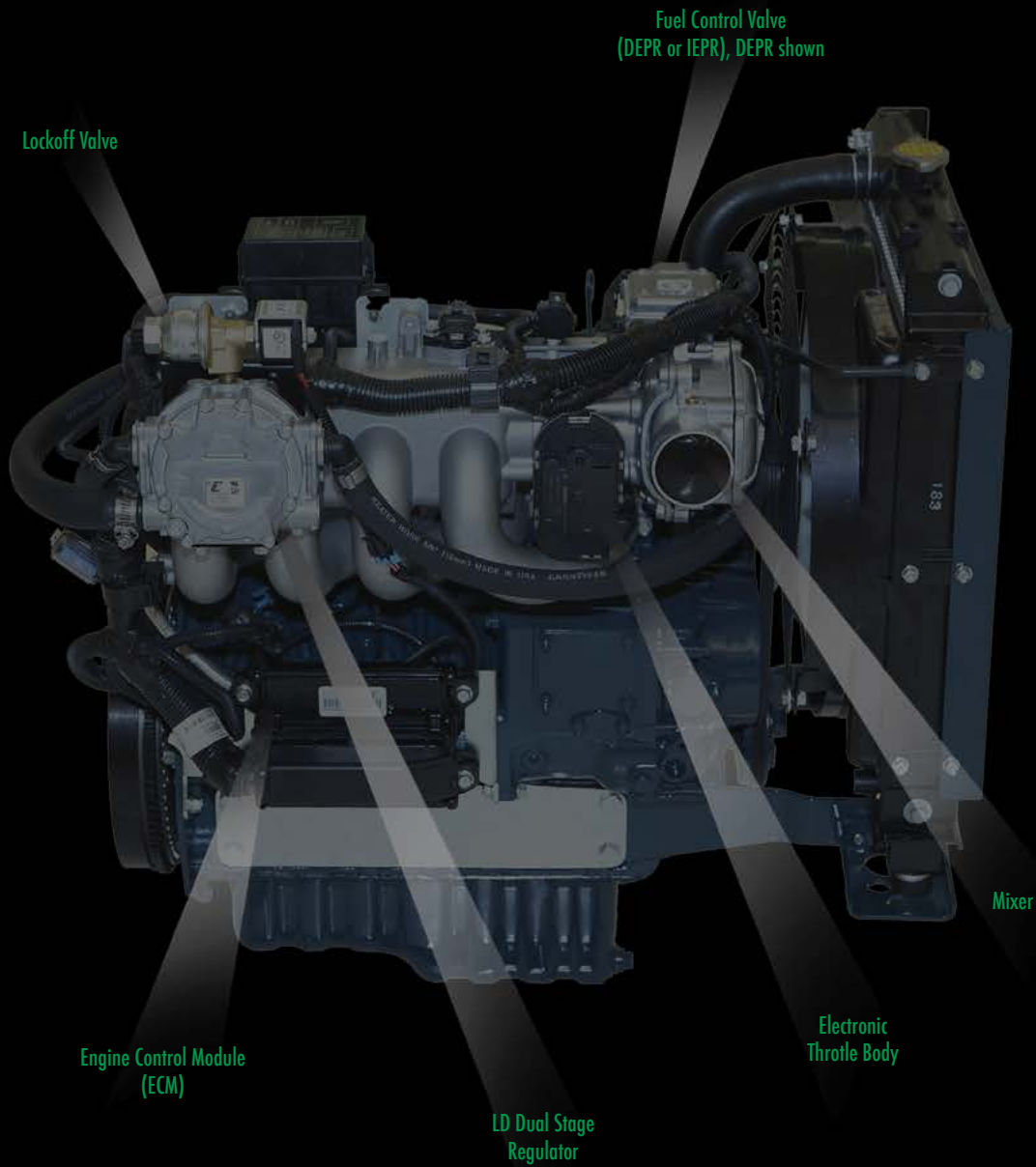
Direct Acting Electronic Pressure Regulator (DEPR)



Electronic Throttle Body



# Industrial Stationary Equipment Systems



Lockoff Valve



Integrated ECM and DEPR (IEPR)



Light-Duty Dual Stage Regulator (LD DSR)



Catalyst



Harness

# ENGINE CONTROLS



90-pin Spark-Ignited ECM



120-pin Spark-Ignited ECM



120-pin Diesel ECM



180-pin Diesel ECM

## Engine Control Modules

We offer a complete suite of Engine Control Modules (ECMs) for OEM applications in heavy-duty truck and bus, industrial mobile, industrial stationary and off-road segments.

EControls' Full Authority Engine Control Modules feature 12 or 24V operation. They are engine-mountable and come in a variety of pin configurations from 23 to 180. Each ECM is sealed to the environment and designed to handle all engine and engine-related inputs and outputs. We have proven model-based control algorithms, enabling reduced development time and improved performance.

For flexibility, we design and manufacture the PCBAs and write the embedded code, application code and display code, which allows us to tailor the engine control module to specific customer requirements. Custom software algorithms are added quickly for hardware optimized to our customers' application. Our ECM serves both as a development platform and the production platform. The ECM software comes with comprehensive diagnostics to meet regulatory on-board diagnostics requirements.

These Engine Control Modules are available for spark-ignited and diesel common rail engines.

## FUEL CONTROLS

### Continuous Flow Valve

The CFV precisely meters the amount of fuel to the engine based on the engine torque demanded. The fuel flows in a controlled continuous stream; this with its accuracy results in optimum combustion and is proven to yield excellent fuel economy, minimized engine out emissions and diesel-like transient response. It features durability that is far superior to traditional injectors and is unaffected by contaminants in CNG or the low lubricity and potential low pressure found with LNG.



### Electronic Pressure Regulator

The EPR is designed to regulate either natural gas, CNG or LPG precisely to a variable venturi mixer. Like the CFV, it presents a controlled continuous flow of fuel to the engine. It has proven to be durable and reliable in the field having the ability to handle the contaminants found in LPG and is particularly well-suited to operate with low pressure natural gas.



## REGULATORS



### Light-Duty Dual Stage Regulator

The LD DSR is a fully mechanical two stage vaporizing regulator used to present the LPG or natural gas to the EPR. The superior heat exchanger improves low ambient temperature performance, and the highly engineered pressure relief system, seals and diaphragms offer superior durability.



### Heavy-Duty Dual Stage Regulator

The Heavy-Duty Dual Stage Regulator is used across a multitude of applications from industrial stationary to on-highway. With highly engineered rugged components, it's designed for extreme durability.



E900 Mixer

E330 Mixer

## MIXERS

### Mixers

Multiple mixers are available for a wide range of engine sizes for LPG, natural gas and bi-fuel applications. The mixer is incorporated in EControls EPR systems and can be used in either open or closed loop applications. Its superior low flow resolution and repeatability eliminate idle adjustment, is resistant to backfire and provides excellent air/fuel ratio accuracy.

## VALVES & SENSORS



### Lockoff Valve

Our Lockoff Valve is used in commercial vehicle and industrial mobile applications. It is designed for extreme durability, including a design target of 500,000 cycles with a temperature cycle profile of -40° to 125° C. It is suitable for LPG, LNG and CNG fuel systems.



### Waste Gate Control Valve

Utilized in commercial vehicle applications, our Waste Gate Control Valve allows full-authority electronic control of pneumatically waste gated turbos. Our unique proportional control strategy extends the durability of the turbo waste gate. With an on-board sensor added, it yields superior engine response and vehicle drivability.



### Boost Recirculation Valve

Our Boost Recirculation Valve is designed to be extremely durable. It is a normally closed valve that opens to allow the high pressure downstream of the turbocharger to recirculate back into the intake air stream and ultimately prevent accelerated wear and fatigue on the turbocharger components.



EnviroTech™ Sensor

### Sensors

Among a wide range of sensors, our EnviroTech™ sensor is suitable for real-time engine control applications. It measures humidity allowing for optimized combustion. Sensor output can be used for general information or to correct engine control parameters and the UEGO sensor output.

Our sensor options used as part of the system include: Wide-band and stoichiometric oxygen sensors; knock sensors; pressure sensors; temperature sensors; and cam and crank speed sensors.

## OTHER PRODUCTS



### Catalyst

EControls developed its own catalyst formulation to optimize precious metal loading. This custom catalyst provides optimized performance at minimum cost.



### Electronic Throttle Body

The Electronic Throttle Body enables high performance speed governing with proven durability and reliability.



### Power Distribution Module

EControls' Power Distribution Module (PDM) expands CAN bus control networks by replacing existing relay and fuse boxes with more reliable solid-state switches. It is designed for use in 12-24V systems and supports CAN J1939 communications, allowing users to remotely monitor and configure inputs and outputs.



### ECOM Cable

The ECOM cable is a USB 2.0 device that allows Control Area Network (CAN) traffic to be transmitted and received using a computer. It was originally designed by EControls to provide a CAN interface for our OEM customers to communicate with our engine control modules.



### Wire Harnesses

The right selection of wire gauge, connectors, shielding, ground points and relays are key to the success of the wire harness. We have been designing harnesses as long as we have been designing controllers. This ensures that we have the ability to offer our customers total control of the system, from component to ECM.

# **ENOVATION** **CONTROLS™**

Enovation Controls, LLC is a global provider of innovative, state-of-the-art products and services for comprehensive engine-driven equipment management and control solutions. Enovation Controls is the company formed from the merger of FW Murphy and EControls in 2009. The company combines FW Murphy's full line of engine instrumentation products with EControl's extensive engine control development, expertise to provide customers with a complete solution approach for engine control, protection and monitoring. Enovation Controls' headquarters is located in Tulsa, Oklahoma. Its complete portfolio of brands include: Murphy, EControls, Computronic Controls and Zero Off.



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