WOODWARD

Application Note 51479
(Revision NEW, 7/2013)
Original Instructions

- Ensures that rich burn natural gas fueled engines stay in emissions compliance
- Maintains the operational health of the engine's three-way catalyst
- Detects and reacts to repeated misfire events
- Improves starting with start fuel limiters
- Provides diagnostic information and fault mitigation options in a convenient, one-box solution

Benefits of Using the E³ Rich Burn Trim Control on Dual Bank Gas Engines

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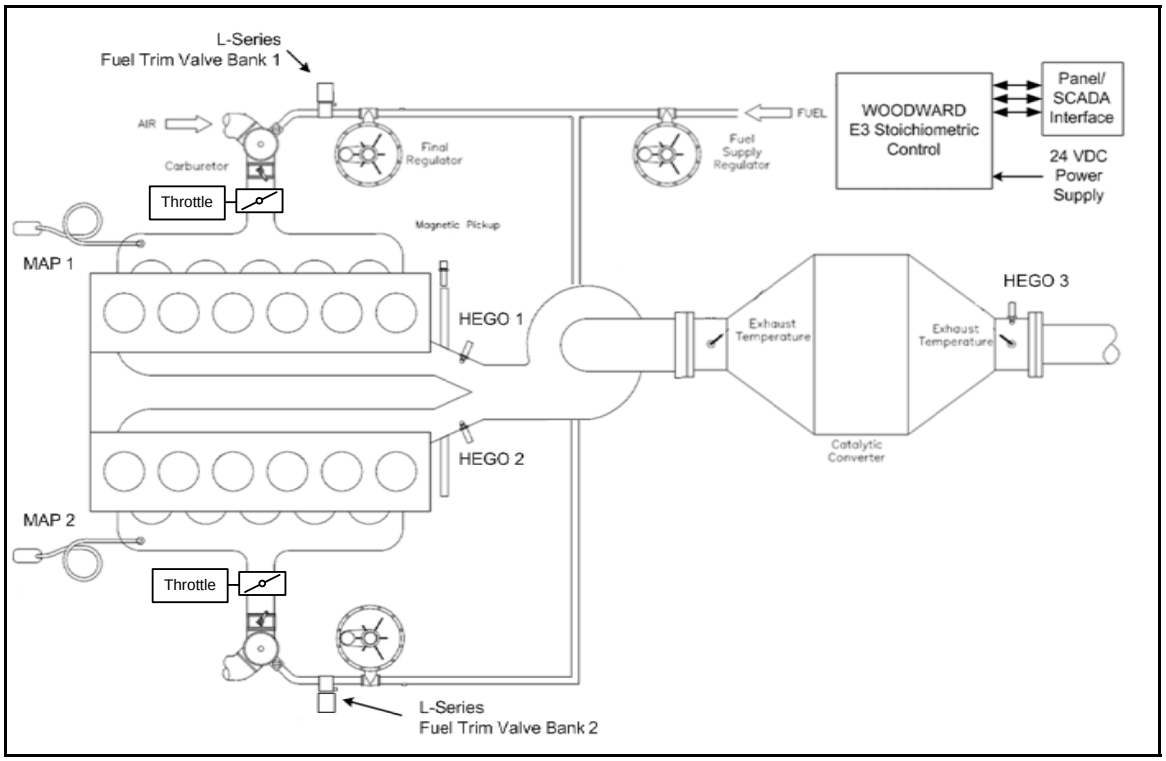
Introduction

The E³ Rich Burn Trim Control is especially beneficial in dual bank (stereo) gas engine applications.



The major benefits of the E³ Rich Burn Control System are most evident in stereo engine applications that use individual fuel trim valves and throttles along with individual HEGO (heated exhaust gas oxygen) sensors to monitor the exhaust from each bank of the engine, as shown in the diagram above. The system's two major benefits involve balancing the load on the two banks of engine cylinders and exhaust emissions compliance.

Load Balancing

The E³ control balances the power between two engine banks by essentially controlling the mass flow of gas and air going to each bank based on the manifold absolute pressure (MAP) and manifold absolute temperature (MAT). The E³ continuously keeps the load balanced between the two banks—even with changes in the turbocharger, intercooler, ambient conditions, and wastegate (eliminating manual wastegate adjustment). It can either alarm or shut down the engine if the measured parameters exceed configurable limits. The E³ continuously prevents overloading one bank over the other. Balancing load reduces engine vibration and internal stresses, allowing the engine to produce its rated power and carry more load effectively.

Emissions Compliance

The E³ Rich Burn Control System controls the AFR (air fuel ratio) for each bank of a stereo engine individually. In doing so, it continuously fluctuates (dithers) the fuel between rich and lean so that the respective exhaust streams fluctuate between rich and lean. The E³ phases the AFR for each bank so that when their exhaust streams merge, a rich section of the exhaust stream from one bank is paired with a lean section of the exhaust stream from the other bank. The resultant combined exhaust stream going to the catalyst is now a balance of lean exhaust with an excess of oxygen and NOx paired with rich exhaust with an excess of CO. This combined exhaust allows the catalyst to work effectively in reducing both CO and NOx simultaneously in the final exhaust stream going to the atmosphere. The E³ accomplishes this phasing by using information from the individual HEGOs to adjust the fuel gas going to each cylinder bank of the engine. The overall effect of this action is to widen the effective emissions window while achieving the same efficiency as a set point emissions control operating under ideal conditions.

We appreciate your comments about the content of our publications.

Send comments to: icinfo@woodward.com

Please reference publication 51479.

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