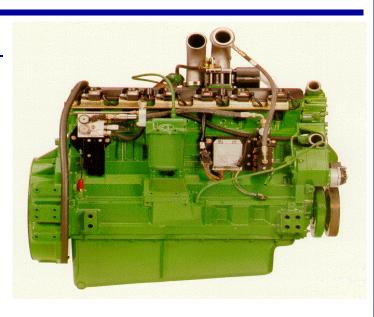


OH-1 Control System

for Heavy-duty, Lean-burn, Natural Gas Engines

Applications

Woodward's OH-1 control system is designed to control heavy-duty, lean-burn natural gas engines in urban buses and trucks and other alternativefueled on-highway vehicles. The highly accurate closed-loop control system helps OEMs meet legislated emission levels, while maintaining diesel-like drivability and excellent fuel economy.

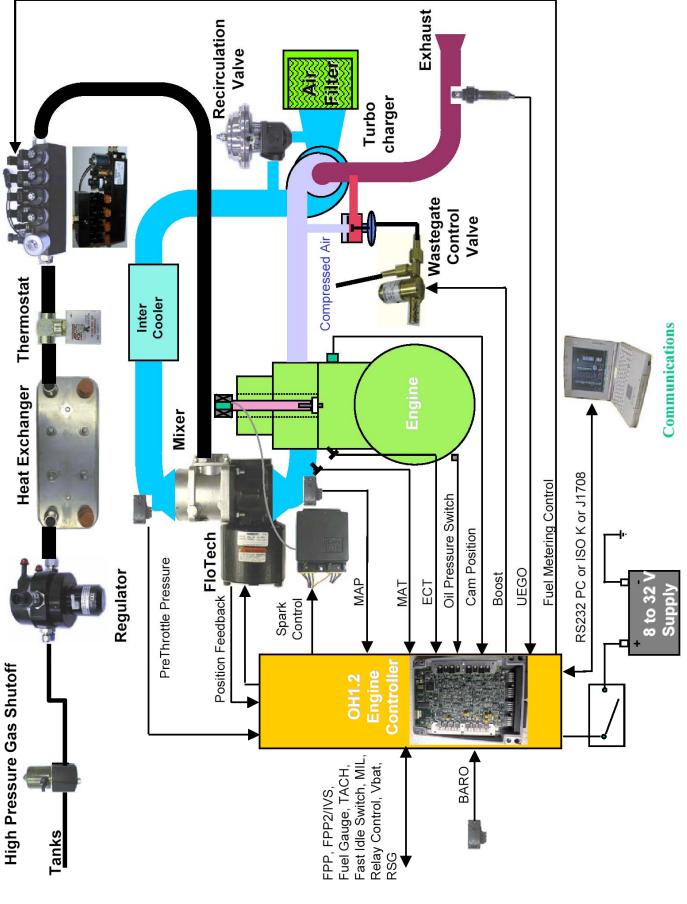


Key Technologies

This system is based on key technologies not available in other control systems on the market. These technologies include:

- High Accuracy, Closed-Loop, Lean-Burn Control Strategy results from using proprietary digital electronics and software technology that overcome the difficulties encountered with wide-range oxygen sensors (UEGO) in other systems available today.
- Full-Authority Drive-by-Wire Strategy is made possible by combining
 Woodward's Flo-Tech™ throttle and electronic wastegate actuator designs with
 advanced load control technologies that provide unmatched fuel economy,
 excellent vehicle drivability, and engine protection from turbo-overspeed and
 engine overboost conditions.
- Precise Open-Loop, Fuel Control Strategy has been designed into our system. The strategy combines additional key sensors and control algorithm technologies that improve the accuracy of volumetric efficient calculations. It also includes advanced manifold filling calculations for handling large transient speed and load changes that must be accommodated in heavy-duty, lean-burn, sparkignited gas engine control systems.
- Advanced Diagnostic Features are a powerful tool for development engineers, as well as field technicians, when diagnosing engine or vehicle problems.
- Model-Based Control Strategy is used to compare actual engine operation with expected values.

- For urban buses & trucks and other alternative-fueled on-highway vehicles
- Helps meet legislated emission levels
- Improves fuel economy
- Diesel-like drivability
- Proven system
- Flexible configurations, available as a complete system or as components
- Complete systems engineering services
- Global engineering and service support



Typical OH-1 Layout

OH-1 Control System Features

- Closed-loop, lean-burn, fuel control with adaptive-learn technology; fully-integrated, wide range oxygen sensor for precise fuel/air ratio control
- Speed-density control strategy with advanced transient compensation; provides improved transient fuel/air ratio tracking and durability over most mass-air flow based systems
- Electronic "Delta-P" wastegate control for improved thermal efficiency, torque rise, and drivability
- High-energy inductive ignition system; up to 6 individual or double-ended coils
- Full-authority drive-by-wire throttle system with min/max governing or all-speed governing
- Idle-speed control includes speed set-point modifications for coolant temperature, time from start, external fastidle switch, and other inputs
- Max. governor uses programmable artificial droop for improved drivability
- High altitude turbocharger overspeed protection
- Constant-power and boost-derate features with inlet air and engine coolant temperature compensated boost
- Advanced "turbo-lag" compensation for improved turbocharger response and drivability
- Deceleration/motoring fuel shut-off for improved thermal efficiency and emissions
- Electronic throttle-body
- Multiple diagnostic and vehicle serial links available, including SAE J1708/J1587, ISO-K, RS-232 hardware interface and several protocol specifications
- Over 100 individual diagnostic codes capable of detecting functional faults, intermittent faults, sensor and actuator failures, and engine protection problems
- Malfunction indicator lamp (MIL) with field-extractable fault code feature
- Extensive engine protection features including limp-home and derate modes for inlet air temperature, engine coolant temperature, oil pressure, overboost, and overspeed
- Fail-safe limp-home feature for all sensor failure modes; the only exception is the speed sensor which may be made redundant if desired
- Knock sensing for real-time adjustment of ignition timing and boost/torque for engine protection

OH-1 Components

ECM—Engine Control Module

Flash programmable module 8-32 volts compatible Supports J1708/1587, ISO-K, RS-232 Built-in digital electronics for NGK UEGO sensor 60 pin I/O

ICM—Ignition Control Module

Inductive ignition On-engine mount 6 cylinder coil per plug/12 cylinders waste spark 12 or 24 volt versions Simple digital trigger/reset function for coil dwell and timing control

Ignition primary monitoring function

High Pressure Gas Shutoff Valve

12 or 24 volt versions Pilot operated valve SAE o-ring gas fittings

High Pressure Gas Regulator

Single-stage regulation—200 bar to 8 bar MAP/boost bias port Tank pressure port for sensor mounting SAE o-ring gas fittings Integrated PRD

Heat Exchanger and Gas Thermostat

Low pressure gas temperature control Optimizes gas density delivered to FMV Thermostat measures gas temperature directly

FMV—Fuel Metering Valve

Single-point metering

On-engine mount Bosch or ServoJet CNG/LNG injectors depending on application 8 or 12 injectors depending on engine power

Integrated positive fuel shutoff

Integrated gas pressure and temperature sensors

Flo-Tech™ Integrated Drive-by-Wire Throttle

8–32 volt compatibility

48, 60, and 68 mm throttle bore sizes Flow shaping for improved idle control Simple PWM, 0-5 V, 4-20 mA, or 0-200 mA control signal

Wastegate Control Valve

12 or 24 volt versions Digital valve provides air pressure to wastegate actuator Vehicle supply or boost air

Technical Manuals 26220 (Calibration)

26221 (Systems)

OH-1 Applications

Complete Systems

- Daewoo Heavy Industries 11 L
- Daewoo Heavy Industries 8 L
- Hyundai Motor Company 11 L
- John Deere 6.8 L
- John Deere 8.1 L
- Mack Trucks 12 L
- Mercedes Benz 5.9 L

OH-1 Components

- Cummins
- Detroit Diesel
- Mercedes Benz









PO Box 1519, Fort Collins CO, USA 80522-1519 1000 East Drake Road, Fort Collins CO 80525 Tel.: +1 (970) 482-5811 • Fax: +1 (970) 498-3058 www.woodward.com

Distributors & Service

Woodward has an international network of distributors and service facilities. For your nearest representative, call the Fort Collins plant or see the Worldwide Directory on our website.

This document is distributed for informational purposes only. It is not to be construed as creating or becoming part of any Woodward contractual or warranty obligation unless expressly stated in a written sales contract.

Copyright © Woodward 2000-2003, All Rights Reserved

For more information contact: